



★ More Original Programs for your Apple II! ★

Inside — A complete, new Apple language!

January 1986
VOL. 7 / NO. 1
U.S.A. \$3.25
CANADA \$4.25

nibble®

THE REFERENCE FOR APPLE COMPUTING

Turtle Basic

Logo power from Applesoft

Nibble Calculator
It's programmable

Tank Combat
Hi-Res action and
strategy combined

Nibble Light Pen
Make your own
for under \$10



Plus ProDOS utilities,
assembly language explained,
games reviewed, and more!

Let's compare ApplesTM to ApplesTM.



An Apple IIc



An Apple IIc with Z-RAM

The Apple IIc on the right works exactly the same as the Apple IIc on the left. Almost. The Apple on the right has a powerful memory expansion coprocessing card called Z-RAM. From Applied Engineering. Which means the Apple on the right can completely load AppleWorks into RAM—and then run it up to thirty times faster than the Apple on the left.

Z-RAM also acts as a solid-state disk drive. Which means the Apple on the right will load and store programs up to 30 times faster. And, our included RAM disk is compatible with Applesoft, PRO-DOS, DOS 3.3, PASCAL and CP/M.

Turbo Charged AppleWorks.

Even a 256K Z-RAM can completely load AppleWorks into RAM. With Z-RAM, the moment your fingers touch the keyboard AppleWorks responds. A 256K Z-RAM lets your IIc run AppleWorks up to 30 times faster, increases available desktop to 235K and maximum number of records from 1,350 to over 16,000, doubles the number of lines allowed in the word processor, provides a print spooler, and auto-segments large files so they can be saved on two or more disks. A 512K Z-RAM boosts AppleWorks desktop to an incredible 425K.

Take a closer look.

There's more. Z-RAM has a built-in high speed Z-80B microprocessor that allows you to run CP/M programs. Which means you now have access to the single largest body of software in existence, including popular packages like WordStar, dBase II, Turbo PASCAL and Microsoft BASIC. A 16 bit option is also available.

And still more. Z-RAM is compatible with all IIc software and hardware, installs easily in just ten minutes with a screwdriver (slightly longer without), is available with 256K or 512K of additional memory (a 256K Z-RAM can be upgraded to 512K at

any time). Z-RAM is easily handled by the IIc power supply with our patent pending power saving design.

The only thing better than that would be a recommendation from Steve Wozniak.

"I recommend Applied Engineering products wholeheartedly." (Of course, Steve's IIc has a Z-RAM installed.)

*Steve Wozniak, the creator
of Apple Computer*

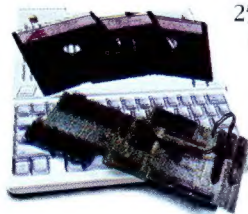


For fast response.

Z-RAM comes complete with simple instructions, RAM disk software, Z-80 operating system, CP/M manual. And a five year "hassle free" warranty. Make a good Apple great. With 256K Z-RAM "384K total" (\$359); with 512K "640K total" (\$419); 16 bit option may be added later (\$89).

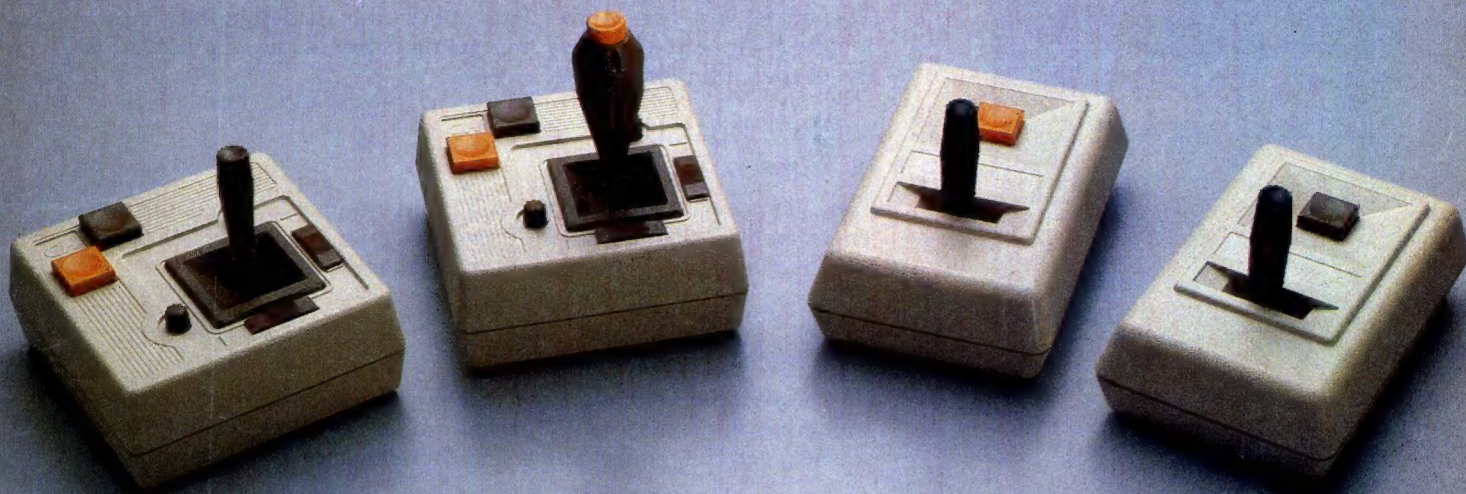
If you want to run CP/M software, but don't need more memory, we suggest our Z-80c card. The Z-80c has no memory expansion ports and is priced at only \$159.

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These highly accurate and reliable 360-degree microcomputer cursor controls used for games, business and graphics applications provide more features, greater durability, and longer life cycles. Plug-in compatible with Apple II, IIE, IIC, IBM PC, PCjr and TRS-80 Color Computers. MACH II \$44.95 / MACH III \$54.95

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We manufacture a complete line of OEM Joysticks for industrial applications. Dealer and OEM inquiries invited. Apple II, IIE, IIC, IBM PC, PCjr and TRS-80 are registered trademarks of Apple Computer Inc., International Business Machines and Tandy Corp., respectively.



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January 1986



cover art by Don Demers

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by J.B. Ward

Talk turtle with your Apple! This utility adds turtle graphics commands to Applesoft for easy, fun graphic designs. Special keywords direct the turtle around the screen.

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by Newton Saiyuen Lee

Turn your Apple into a full-function, programmable calculator. This super calculator features a range of built-in arithmetic and trig functions, plus provisions for five user-defined programs.

56 TANK COMBAT

by Rudy A. Guy

Play against the computer in a deadly simulation of World War II tank combat. Strategy and foresight are key as you maneuver to defend your HQ, ammo dump and fuel depot against enemy fire.

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by Jim Lazar

Return to the days of the blinking box cursor! Customize your //e or //c with a solid box cursor, or choose another character instead.

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by Ken Manly

Take a peek at your VAR files. This ProDOS VAR file reader lists the names and values of all the real, integer and string variables in your Applesoft programs.

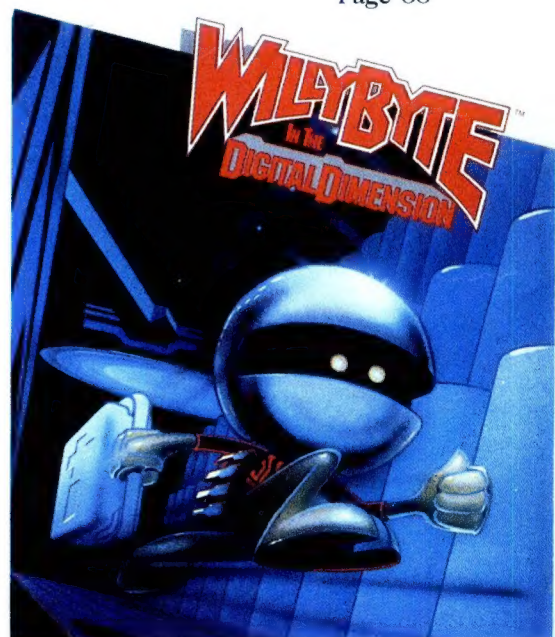
USER VIEWS

88 GAMES!

Reviewed by John DiPrete

Enter the world of high-stakes real estate, cast spells with a wishing stone, solve a crime and man a space station. It's all in a day's play for seven new games that range from interactive fiction to educational software.

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The Reference for Apple Computing

NIBBLING AT ASSEMBLY LANGUAGE

93 PART V: FIRST COUSINS ONCE REMOVED

by *S. Scott Zimmerman*

Learn how to use 65C02 addressing modes in your own programs. Demonstration programs show you how to implement arrays, print messages to the screen and use the ampersand vector. Plus the author gives valuable tips and examples of how to use ROM routines.

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by *Keith Stattenfield*

Catalog every file on your ProDOS disks. Instead of cataloging each subdirectory separately, this nifty program lists all the files in every subdirectory on any ProDOS disk.

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Unravel the complexities of the ProDOS BASIC Interpreter. In this installment, Sandy Mossberg takes on the output handling routines and provides a fix for a BI bug.

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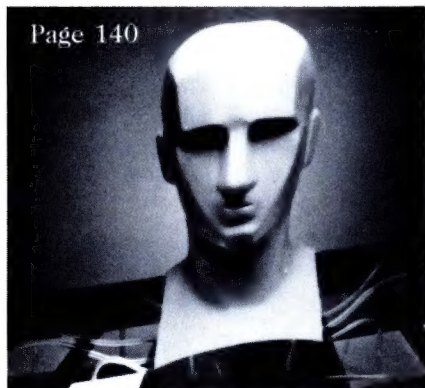
130 NIBBLE LIGHT PEN

by *David Gauger II*

Assemble your own light pen for fast, simple screen input. All you need are \$10 worth of parts, a short machine language routine and our construction tips.



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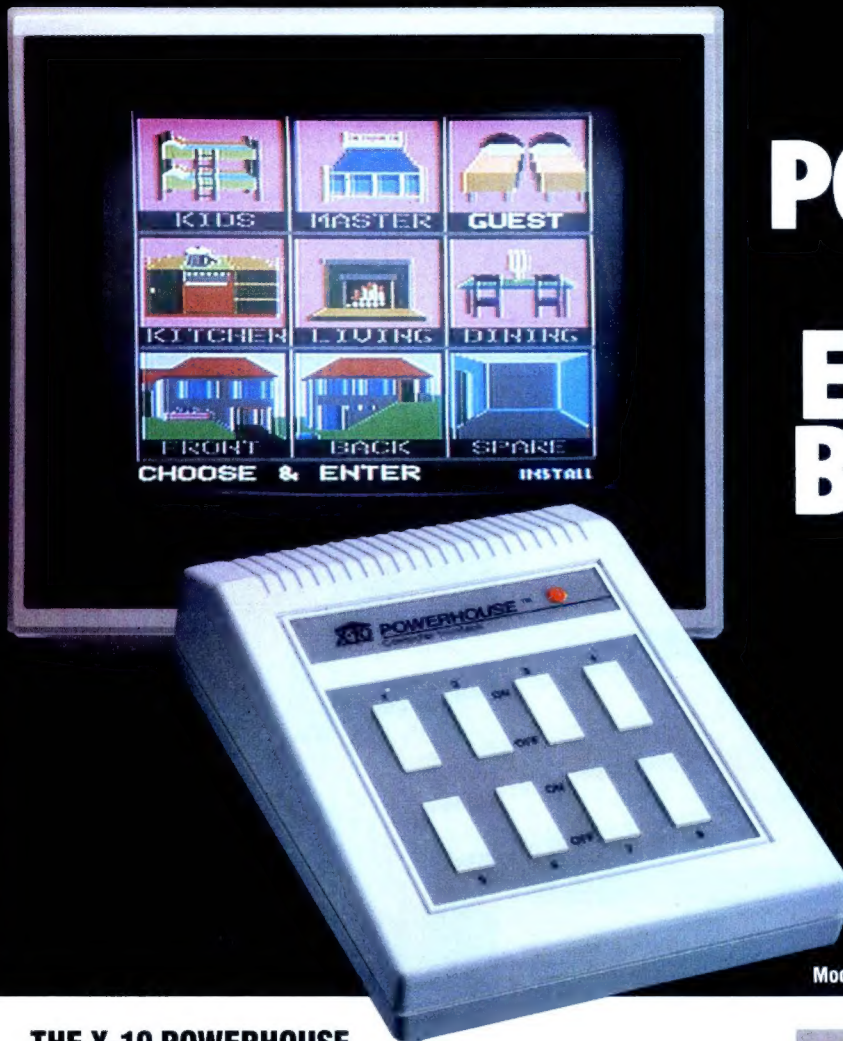
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This remarkable Interface lets you run your home through your Apple IIe or IIc and a mouse, keyboard or joystick.

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SPECIAL COLOR GRAPHICS MAKE PROGRAMMING A SNAP.

You simply pick a room from the display screen. Use your mouse, joystick or keyboard to position graphics of lights or appliances. Then follow on-screen instructions to program any light or appliance to go on or off whenever you choose. You can even control thermostats, light intensity and more.



THE WAY IT WORKS. The X-10 Powerhouse Interface is cable-connected to the Apple RS-232 port and plugged into a standard 110V outlet. After it is programmed, the Interface sends digitally encoded signals through your home wiring to special X-10 Modules. To control a lamp or appliance, you simply plug the electrical device into a Module and then plug the Module



into an outlet. The Interface can control up to 256 Modules throughout your home and won't interfere with normal use of lights and appliances.

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SURPRISINGLY INEXPENSIVE. A Powerhouse System including the Interface, software and connecting cables costs less than \$150. X-10 Modules are less than \$20 each.

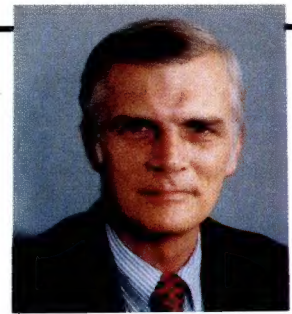
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ELEPHANTS AND ANTELOPES



W

VIEWPOINT

With this issue, we begin our seventh year of publication. We've also reached a major milestone: with this issue, we expect to exceed 100,000 immediate circulation for the first time in *Nibble's* history. Thank you for helping to make it happen! Your encouragement and support have kept us going when other, far larger magazines have foundered and failed. We were particularly saddened to see the demise of Creative Computing and Popular Computing this past year.

ELEPHANTS

Elephants have big appetites. That applies to businesses too. One of the unwritten business guidelines that we used to hear about when I worked for Xerox was: "We're not interested in any business that produces less than \$100 million of annual revenue."

In a recent interview, David Ahl claimed that he projected a million dollar profit for Creative Computing a short time before the decision was made to cease publication. He said that he wasn't sure whether the decision makers didn't believe him or thought it wasn't enough.

When the decision was made to kill Popular Computing, the staff had just moved into a new \$1.2 million headquarters building, and the magazine claimed a paid circulation of more than 300,000. It either wasn't big enough or wasn't profitable enough to survive.

In the last several years, more than 50 computer magazines have ceased publication. The battlefield is littered with big names. It's happening in software as well.

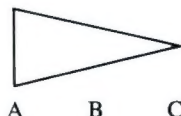
ANTELOPES

Antelopes are fast, little creatures. They don't eat a lot — at least not as much as elephants. They have no excess bulk. They are survivors. A company that's an antelope is delighted to sell 3,000-5,000 software packages a month. An elephant thinks that kind of performance spells failure.

Stewart Alsop, formerly with InfoWorld, made an insightful comparison between Lotus and Microsoft. He pointed out that Lotus hasn't figured out how to make money with small products. Microsoft has. What Lotus does with six products (and really with 1-2-3 as the predominant product), Microsoft does with more than 30 products. Lotus is looking more and more like an elephant, while Microsoft appears to be a herd of antelopes.

THE OPPORTUNITY WEDGE

A classic management model states that OPPORTUNITIES ARE CONTINUOUSLY CLOSING. It applies to a wide variety of business and personal experiences, and it can be represented as a wedge like this:



Point A is the beginning of an opportunity. When VisiCorp popularized the spreadsheet, there were no spreadsheets on the market.

The opportunity was huge, and VisiCorp capitalized on it with almost no competition. But the opportunity began to shrink.

At point B, the opportunity is maturing. Competition, market saturation, product obsolescence, bad pricing, and a myriad of other market forces enter into the picture.

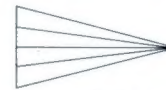
Point C is the disappearance of the opportunity. At this point the profit or market is no longer big enough for survival.

NEW WEDGES

Of course, the wedge can be made to move by introducing new technology, creativity and market product development.



The double wedge defines a Lotus-like phenomenon with one product dominating the financial/market scene. It remains to be seen whether the second wedge will be of Lotus' creation or whether it will be created by another company (repeating the VisiCalc phenomenon).



This wedge defines an equally large opportunity that is constructed of many smaller, more diverse opportunities. It is most representative of companies like Microsoft and a host of other smaller companies that survive and thrive on a variety of small enterprises.

NIBBLE... MANY WEDGES

Nibble is made up of many wedges. Circulation, advertising and more than 150 software products all fit into a supportive relationship that keeps the lights burning. This strategy of controlled, diversified growth has enabled us to survive and prosper while a lot of elephants have starved.

Several years ago, we had two opportunities to be acquired by much larger publishing companies. The offers were tempting, since they would have made my family financially independent for life. And an acquisition held the promise of a major infusion of resources that would make *Nibble* the biggest Apple magazine in the market.

Today, I am convinced that if we had allowed ourselves to be acquired, we would no longer be in business. The weekend that I had to reach a decision, I went out into the yard, sat under a tree and thought about priorities. I thought about you, our readers and advertisers. I thought about our employees — some of the finest in the business. And I thought about how elephants live and die.

As we enter our seventh year of publication, let me thank you once again for helping us keep the antelope spirit and vitality.

Mike Harvey

Mike Harvey
Publisher

New Dimensions Of Sound From Your Apple



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Music Concepts
Guitar Master
Music Star
Bank Street
Music Writer
Music
Construction Set
Adventure
Construction Set

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MOCKINGBOARD D is a stereo music, sound and speech synthesizer for the Apple IIc. Suggested retail price \$195.00.

THE DEVELOPERS' TOOLKIT provides easy-to-use software allowing you to incorporate music, sound and speech into your own BASIC programs. In addition, the Toolkit contains numerous other helpful utilities to simplify programming and make learning fun. Retail for \$29.95

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FOREIGN LANGUAGE RULE TABLES allow your computer to speak to you in French, German and proper British English. Retail for \$24.95.

*The new Mockingboard D supports Music Construction Set at the time this ad was sent to press. Check with your dealer for new titles that are being written for this Mockingboard.

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SWEET MICRO SYSTEMS, INC.
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LETTERS

Foolproof Exhumation

I think I've discovered a bug in Sandy Mossberg's EXHUME.FILE program ("Recovering Deleted ProDOS Files," Vol. 6/No. 10). If I rename a file to a shorter file name (e.g., RENAME LONGFILE, LONG) and then delete the file, EXHUME.FILE is unable to recover it. Also, EXHUME.FILE can't restore a file once the disk has been

renamed using FILER. What gives?

*Gino Fortunato
Baton Rouge, LA*

Sandy Mossberg replies:

Right you are, Gino. My shortsightedness about renamed files has created unneeded frustration. After expanding upon your

explanation for the cause of the malfunction, I shall provide a short fix.

Within each file header or entry, the file name field (FNF) consists of 15 bytes. The low order nibble of the preceding byte contains the length of the file name (NLF). When a file is created, its name and name length are placed within the FNF and NLF, respectively.

No printer interface card ever sounded this good

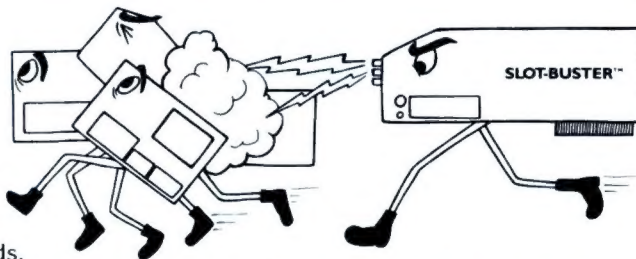
RC System's Slot-Buster™ is the single card solution for all of your Apple's interface needs. The Slot-Buster enables you to use two printers simultaneously with up to 24K of buffering, replacing two printer and two buffer cards.

And with our upcoming low-cost dual buffer expansion card, you can enjoy up to 280K of high speed print buffering, saving you even more time and money.

The Slot-Buster's advanced speech and sound synthesizer will bring new life to your programs, old and new alike. Computer voice output has always been the talk of the future, but the Slot-Buster brings it to your Apple today with style. In fact, it's so easy to use that you can have many of your programs talking the same day you install your Slot-Buster!

Features

- Buffered intelligent parallel and serial printer interfaces
- Compatible with virtually all printers
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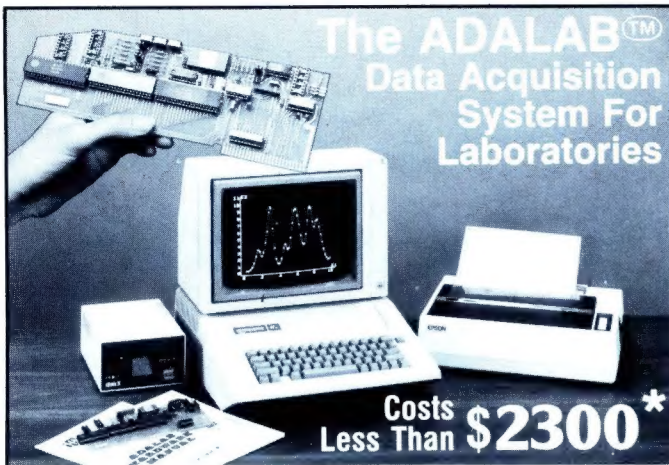


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CIRCLE NUMBER 28

APPLE(II+)WORKS™ PLUS-WORKS™ It really works!!

PLUS-WORKS not only allows you to have all features of AppleWorks™ on an Apple II™, II+ or compatible, but our extended memory versions give you capabilities far beyond the standard IIe/c versions. Its great for expansion on the Apple IIe as well.

Compare these features with other AppleWorks patch programs

- Copyable - make backups, transfer to hard disk
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- Database expansion to more than 4,200 records
- All control codes available to printer
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- Supports all major 80 column cards
- Permanent and dynamic ram disk features
- All versions of AppleWorks supported
- Expand AppleWorks desktop into CP/M ram cards
- Optional patch to help with printer problems

SPECIAL OFFER Thru March 1, 1986, send us our competitor's II+ modifier for AppleWorks (original disk or proof of purchase required) for a **\$20.00** credit towards the purchase of our XM or XMP programs.

• **PLUS-WORKS** - \$19.95 plus \$3.00 ship/hand. Requires AppleWorks, 64K Apple II+ or compat, 80 col card and shift key mod. Maximum desktop 10K. You may upgrade to XM or XMP for \$30.00 at any time.

• **PLUS-WORKS-XM & XMP** - \$49.95 plus \$3.00 Ship/hand. XM requires same as above with legend, saturn, or compatible ram card (A.P.P.L.E. Big board, know Drive, prometheus, etc) or Apple IIe with ramcard. XMP requires CP/M card with 64K ram (ALS, PCPI or Micropro).

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CIRCLE NUMBER 29

LISTING 1: TANK.COMBAT (continued)

```

3220 FOR I = 8 TO 1 STEP - 1: FOR J = 1 TO
18: GOSUB 3530
3230 IF N = 2 AND A$(I,J) = "" THEN A$(I,J) =
"MI":FL = FL + 1: IF FL = 6 THEN I = 1:J
= 18
3240 NEXT J,I: IF FL < 6 THEN 3220
3250 FL = 0
3260 FOR I = 3 TO 1 STEP - 1: FOR J = 1 TO
18: GOSUB 3530
3270 IF N = 1 AND A$(I,J) = "" THEN FL = FL +
1:A$(I,J) = STR$(FL) + "C":XC(FL) = I:
YC(FL) = J: IF FL = 6 THEN I = 1:J = 18
3280 NEXT J,I: IF FL < 6 THEN 3260
3290 FOR I = 1 TO 3: FOR J = 1 TO 18
3300 IF VAL (A$(I,J)) > 0 THEN XDRAW 36 AT
J * 14,Y + (I * 9)
3310 NEXT J,I
3320 REM HUMAN LOCATIONS
3330 POKE 34,20: HOME
3340 REM PLACE HQ
3350 OB$ = "HQ": GOSUB 4120:RS = 16:RE = 9:R =
16:C = 1:SH = 32:A$ = "K": GOSUB 3710
3360 A$(R,C) = "HQ2"
3370 OB$ = "AMMO DUMP": GOSUB 4120:RS = 16:RE
= 9:R = 16:C = 1:SH = 33:A$ = "K": GOSUB
3710
3380 A$(R,C) = "AD2"
3390 OB$ = "FUEL DEPOT": GOSUB 4120:RS = 16:R
E = 9:R = 16:C = 1:SH = 34:A$ = "K": GOSUB
3710
3400 A$(R,C) = "FD2"
3410 FOR K = 1 TO 6
3420 OB$ = "TANK MINE #" + STR$(K): GOSUB 4
120:RS = 16:RE = 9:R = 16:C = 1:SH = 19:
A$ = "K": GOSUB 3710
3430 A$(R,C) = "MI2"
3440 NEXT
3450 FOR I = 1 TO 6:C = 1:OB$ = "TANK #" + STR$
(I): GOSUB 4120
3460 RS = 16:RE = 14:R = 16:C = 1:SH = 31:A$ =
"K": GOSUB 3710
3470 A$(R,C) = STR$(I) + "H":XH(I) = R:YH(I
) = C
3480 NEXT
3490 FOR I = 9 TO 16: FOR J = 1 TO 18
3500 IF A$(I,J) = "MI2" THEN XDRAW 19 AT J *
14,Y + (I * 9)
3510 NEXT J,I
3520 RETURN
3530 REM PICK RND NO.
3540 N = INT ( RND ( PEEK (78) + PEEK (79) *
256) * NU) + 1
3550 RETURN
3560 REM DRAW AND ERASE TANK MINE
3570 FOR D = 1 TO 10: XDRAW 19 AT C * 14,Y +
(R * 9): FOR E = 1 TO 50: NEXT : NEXT : RETURN

3580 REM SHOW WHERE SHOT LANDED (COMPUTER)
3590 CALL 768
3600 FOR D = 1 TO 20: XDRAW 35 AT CY(I) * 14
,Y + (CX(I) * 9): FOR E = 1 TO 50: NEXT
E,D: RETURN
3610 REM SHOW WHERE SHOT LANDED (HUMAN)
3620 CALL 768
3630 FOR D = 1 TO 20: XDRAW 35 AT HY(I) * 14
,Y + (HX(I) * 9): FOR E = 1 TO 50: NEXT
E,D: RETURN
3640 FOR D = 1 TO 3000: NEXT : RETURN
3650 HTAB 21 - LEN (M$) / 2: PRINT M$: RETURN

3660 FOR X = 768 TO 781
3670 READ Y: POKE X,Y: NEXT
3680 RETURN
3690 DATA 160,20,169,50,32,168,252,173,48,19
2,136,208,245,96
3700 REM MOVE SHAPES ON SCREEN USING I-J-K-
M AND <SPACE>.
3710 IF SH = 37 THEN GOSUB 4050: GOTO 3790
3720 IF SH = 31 THEN IF A$(R,C) = "B" OR RIGHT$
(A$(R,C),1) = "H" OR RIGHT$ (A$(R,C),1)
= "C" THEN 3850
3730 IF FL THEN FL = 0: GOTO 3720
3740 IF SH = 19 THEN IF LEFT$ (A$(R,C),1) =
"M" THEN 3850
3750 IF FL THEN FL = 0: GOTO 3740

```


should have provided a program with AppleWorks for easy conversion of Applewriter and other text files to AppleWorks word processor files. Such a conversion program is provided with the database to convert Quickfile data.

The process for converting DOS 3.3 text files, like those created using Applewriter, is not self-evident, involves several steps, and you must own a copy of ProDOS. Here is my method:

1. Write down the names of the DOS 3.3 text files that you wish to convert. Boot the ProDOS User's Disk and choose F (ProDOS Filer), then V (Volume Commands). Next, choose F (Format a volume). Type in and write down the new volume name (the prefix). Remove the ProDOS User's Disk or set the formatting for drive 2, insert a fresh disk and proceed to format it.
2. Replace the ProDOS User's Disk. Go back to the main menu (via Quit or by rebooting) and select C (the conversion option). At this point, if you are unfamiliar with the use of the conversion program, type a question mark to display instructions.
3. Remove the ProDOS User's Disk and insert the DOS 3.3 and ProDOS formatted disks, as shown under "Direction". Be sure that the slot and drive numbers are set correctly in the conversion program (if not, use C to change them). Set the ProDOS prefix using

menu option P, and type in the prefix you gave in number 1 above. (Use the <RETURN> key to eliminate any extra characters in the prefix). Check to see that the arrow is set correctly for the direction of the conversion — if it is not correct, use R to correct it.

4. Choose option T to transfer the files from the DOS 3.3 disk to the ProDOS disk and proceed to transfer the files according to the directions you read in step 2 above. If you have forgotten the file names to be transferred, enter a

question mark instead of the file names to display a catalog of the disk files. The transfer option converts DOS 3.3 ASCII text files to ProDOS ASCII text files. However, an extra step is required to convert the latter to AppleWorks word processor (WP) files. Remove the DOS 3.3 disk and place the new ProDOS text disk in drive 2.

5. Boot AppleWorks. Choose the "Add Files" option and "Make a new file for the Word Processor." Then choose option 2 for a text (ASCII) file.

continued on page 146

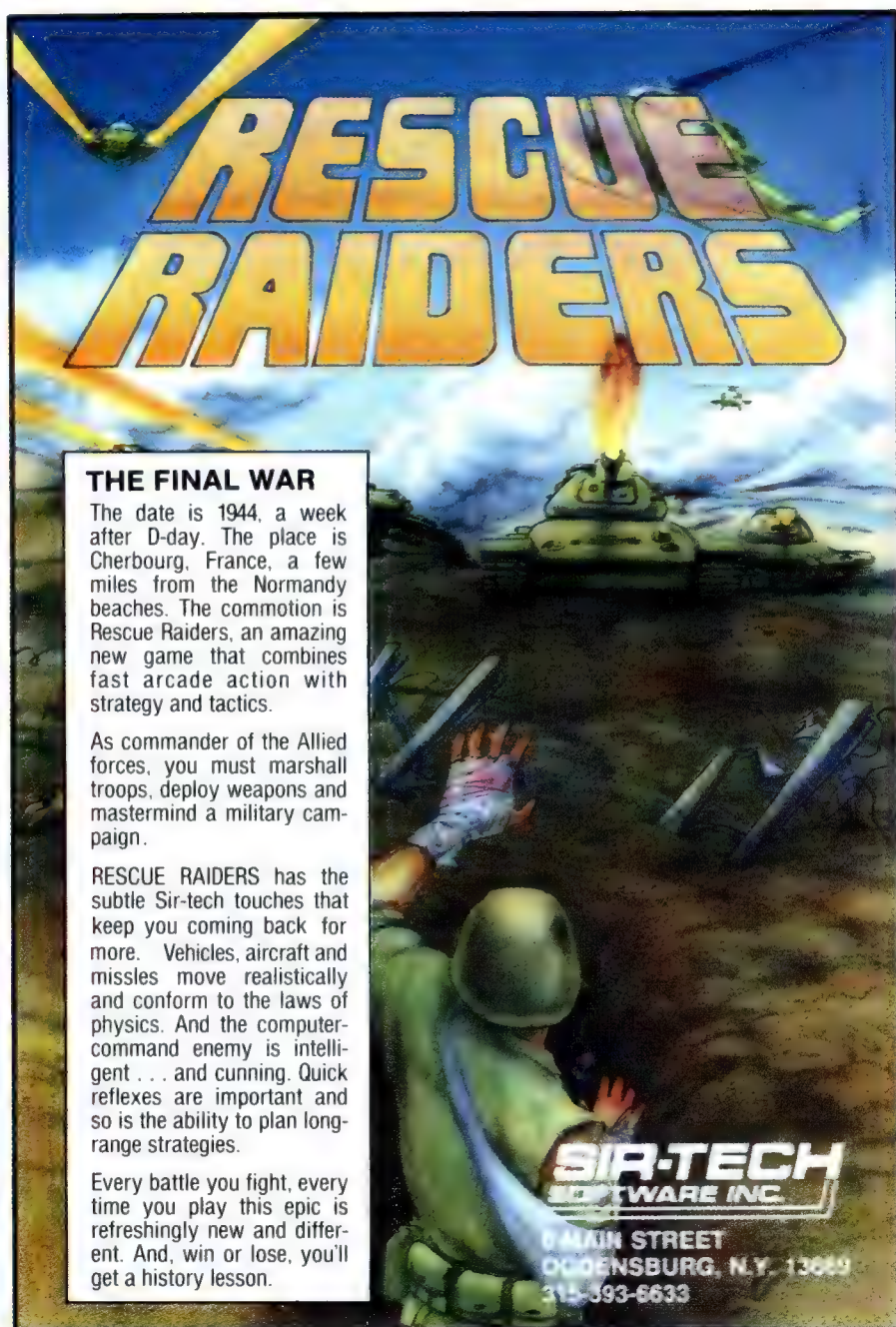
ERRATA AND ENHANCEMENTS

Attention Telecommunicators: Now you can receive errata notices and other goodies quicker than ever on the 1200/300 baud Nibble Hot Line. Have your Apple call our Apple at 617-369-8920. Your communications software should be set at 8 data bits, 1 stop bit, no parity, full duplex. The Hot Line will automatically determine the correct baud rate.

Super Shopper (Vol. 6/No. 11, p. 22): To fix a problem with Epson printers not entering 132-character mode, change line 290 as follows:

290 P132\$ = CHR\$(15)

Nibble MeterMan (Vol. 6/No. 10, p. 28): To fix a problem with the printout of the 80-column screen, eliminate the semicolon in line 1890.



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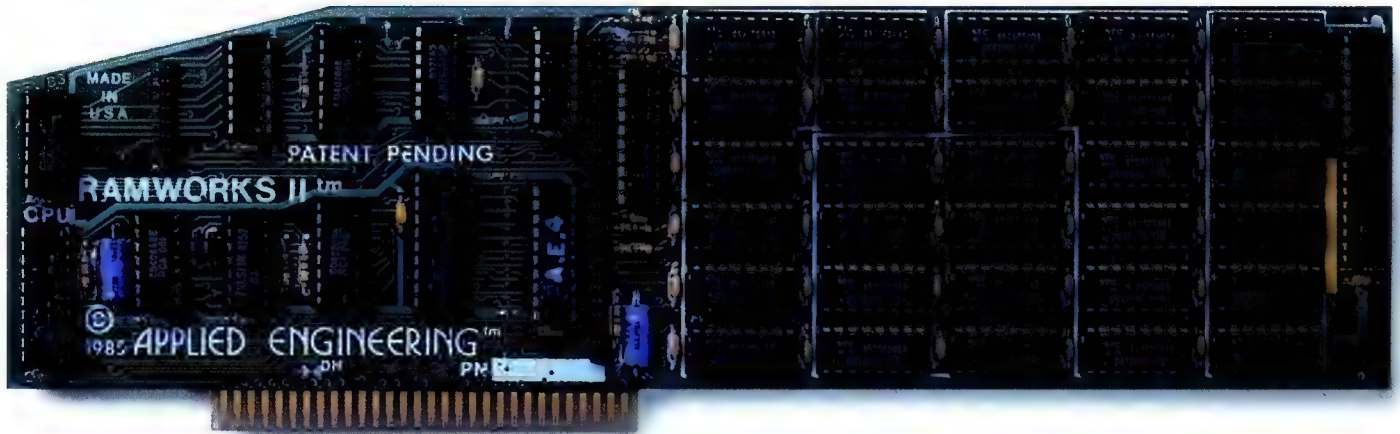
Every battle you fight, every time you play this epic is refreshingly new and different. And, win or lose, you'll get a history lesson.

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256K	188K
512K	378K
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1.5 MEG	1136K
3 MEG	2277K

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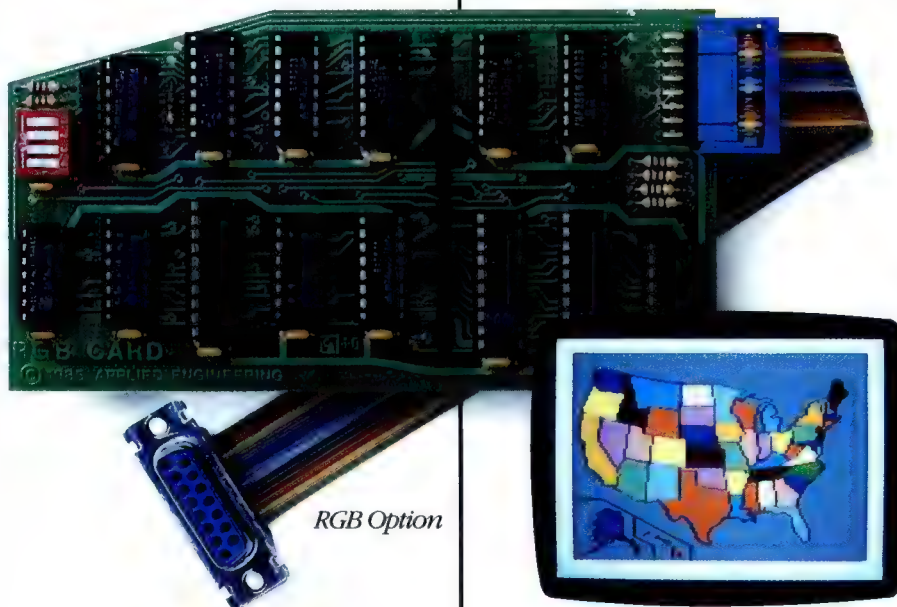
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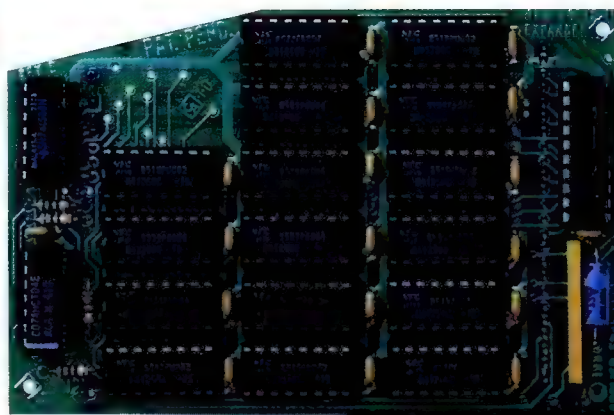
RGB Option

the RGB option with your RamWorks II. Or add it on at a later date.

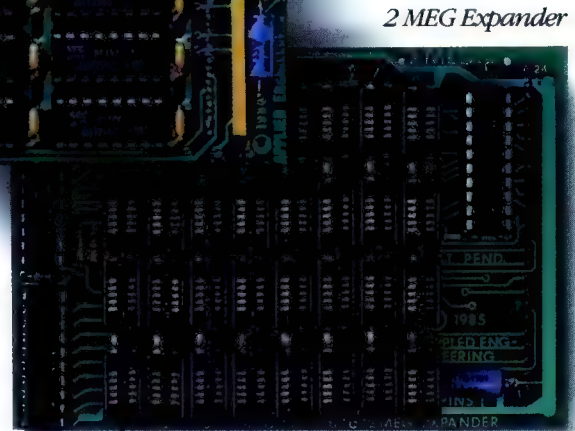
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A WELCOME TO NEW NIBBLE READERS

Welcome to *Nibble*, one of the finest publications available for Apple owners. Each month, *Nibble* publishes an outstanding collection of programs for your Apple along with explanations of how they work.

If you're new to computing, however, you may find the world of Apple a bit confusing at first. If this is the case, perhaps the best advice would be to spend some time with your Apple manuals. (Owners of the Apple IIe may be interested in reading the two-volume set of manuals on Applesoft BASIC available through dealers.) While this short summary is no substitute for the manuals, it should be enough to get you started on *Nibble's* program listings.

A QUICK OVERVIEW OF THE APPLE

When you first switch on your Apple, with a disk in the drive, you will most likely see a 'J' character, called a prompt. The 'J' prompt tells you that you can do one of three things:

1. Give commands in the disk command language (e.g. CATALOG).
2. Give commands in Apple's version of the BASIC language, Applesoft BASIC (e.g. PRINT 36+42).
3. Type in Applesoft BASIC program lines (e.g. 10 INPUT K).

To type in programs from *Nibble*, you may need to do all three.

ENTERING AN APPLESOFT BASIC PROGRAM

Before entering a program listing from *Nibble*, you should first thoroughly read the article accompanying the program. You may not understand all of the explanations the first time through, but be on the lookout for any special directions for typing the program. You should also be sure to have an initialized disk ready so that you can save your work. (See your disk drive manual or IIe owner's manual for details on initializing disks.)

All BASIC programs consist of a sequence of program lines. Each program line begins with a number and is followed by one or more program statements separated by colons. For example:

```
20 FOR J = 1 TO 5:PRINT CHR$(7):  
NEXT J
```

To enter a program, begin with the first numbered line and type it in exactly as it appears (including the line number itself). Though the program line may span several printed lines in the listing, do not press <RETURN> (the RETURN key) until you reach the next line number. Then begin the process again with the next line number. When you reach the end of the program, save your work on the disk by typing the command SAVE followed by the name of the program. That's all there is to it!

LISTING 1

```
10 REM RING THE BELL  
20 FOR J = 1 TO 5:PRINT CHR$(7)  
NEXT J  
30 END
```

To enter the sample program BELLS shown in Listing 1, you should follow this sequence:

1. Type the word NEW <RETURN> to clear memory of any old programs. (Make sure the <CAPS LOCK> key is down if you are using an Apple IIe.)
2. Type line 10 exactly as it appears, but do not press <RETURN> until you have typed the last word in the line, "BELL".
3. Repeat this procedure with lines 20-30.
4. With an initialized disk in the drive, type SAVE BELLS <RETURN> to save your program on the disk.
5. Since the program is now in memory, you may just type RUN <RETURN> to start it. If you erase it from memory by running a different program or by turning off your computer, you may put it back into memory and start it again by typing the command RUN BELLS <RETURN>.

A FEW TIPS

The following tips may make your work a little easier:

1. If you make a mistake while typing, use the back arrow key to go back and correct it, and the forward arrow key to "retype" the remainder of the line before pressing <RETURN>. If you have already pressed <RETURN> before you catch your error, simply retype the entire line (number and all) and the new version will take the place of the old. (The use of an Applesoft line editor like MicroSPARC's GALE can eliminate much of this work.)
2. Be particularly careful when typing in statements that contain DATA. Typos in other lines will probably show up as SYNTAX ERRORS when the program is finally run, but those in DATA statements may not.
3. Save the program to disk periodically as you go along to minimize the effect of an accidental power loss.
4. Don't try to make your own modifications to the program until you have typed it in as published and have run it successfully. This will make it easier to debug in case you have made typing errors. MicroSPARC's KEY PERFECT program and the tables published along with program listings can be used to check

your typing and report any lines containing errors. See the advertisement in this issue for details.

5. Lower-case letters may only be used within statements that begin with either REM or DATA, or between quotes.
6. If the program does not seem to run correctly, it may be helpful to temporarily remove any ONERR statements. This will allow you to see error messages suppressed by ONERR.
7. If you're certain that you have typed the program correctly, but you still can't get it working, call *Nibble's* Technical Support Office at (617) 371-1660 for assistance.

ENTERING MACHINE LANGUAGE PROGRAMS

Both BASIC and the disk command language are powerful languages that interpret English-like words. Your Apple can also understand a much lower-level language, called machine language. Since this is the Apple's "native tongue," machine language programs perform much more quickly than those written in BASIC.

Often, a program called an assembler is used to help create machine language programs. An assembler first allows the programmer to write an assembly language program and then translates this program into machine language before it is run. Though you may not have an assembler, you will still be able to extract and use the machine language from *Nibble's* listings. The advantage of an assembler is that it allows you to easily modify the program, or to "borrow" a programming technique.

If you don't own an assembler, you will need to enter machine language programs directly into the Apple's memory through what is called the System Monitor (not to be confused with your video monitor). To reach this level from the disk/BASIC level (indicated by the 'J' prompt), you simply type CALL-151 and press <RETURN>. You will then see an asterisk (*), which is the prompt for the System Monitor. While you can use many commands at this level, the only one you will need to enter *Nibble* listings looks like this example:

```
300:A2 05 20 DD FB CA F0 03 4C 02  
03 60 <RETURN>
```

In this command, the "300" specifies a memory location in your Apple and the colon tells the Apple to put the following number (A2, a number in base 16) into that location. The numbers following the first (05 through 60) are put into subsequent memory locations. Though you don't need to understand base 16 (or hexadecimal) numbers, you should know that all machine language numbers are given in hexadecimal notation.

A SAMPLE MACHINE LANGUAGE PROGRAM

Let's follow a short example of entering a machine language program. Listing 2 shows the contents of a portion of the Apple's memory, often called a "hex dump." The number to the left of the hyphen is a memory location's "address," and the numbers to the right are the contents of that and subsequent memory locations. Often such a listing will be preceded by two numbers separated by a period (.). These numbers are the starting and ending addresses of the part of memory shown.

LISTING 2

```
300.30B
0300- A2 05 20 DD FB CA F0 03
0308- 4C 02 03 60
```

Listing 3 shows the assembly language which was used to create the machine language program shown. Notice that the numbers in the left-hand columns look very similar to those in Listing 2. They are, in fact, the same set of memory addresses and their program contents in a different format. All of the columns on the right are assembly language instructions and comments. While other assemblers use slightly different formats, you will always be able to find the two columns which contain the addresses and contents of memory.

LISTING 3

```
1 *RINGER PROGRAM
2      ORG $300
3 BELL EQU $FBDD
0300: A2 05 4      LDX #$5
0302: 20 DD FB 5      LOOP JSR BELL
0305: CA 6          DEX
0306: F0 03 7      BEQ END
0308: 4C 02 03 8    JMP LOOP
030B: 60 9      END RTS
```

To enter the machine language listings, you just type in the addresses and their contents as follows:

1. Type CALL-151 <RETURN> to get into the System Monitor. You should now have an asterisk (*) prompt.
2. Type the first memory address shown, a colon (instead of the hyphen shown in the listing), and the memory contents. If you were using a listing similar to Listing 2, you would type:

```
300:A2 05 20 DD FB CA F0 03
<RETURN>
308:4C 02 03 60 <RETURN>
```

If you were using an assembler listing like that in Listing 3, you would type:

```
300:A2 05 <RETURN>
302:20 DD FB <RETURN>
305:CA <RETURN>
306:F0 03 <RETURN>
308:4C 02 03 <RETURN>
30B:60 <RETURN>
```

Be sure that you do not put a space between the colon and the first pair of hexadecimal digits, but that you do put spaces between subsequent pairs. You may actually type up to 85 pairs of digits after each colon, but it is easier to follow the listing as published for your first time through.

3. When you have entered the entire listing, press <CTRL><C><RETURN> to get back to the disk/BASIC level indicated by the 'J' prompt. This is accomplished by pressing the C key while holding down the Control key, and then pressing the <RETURN> key.

4. Although BASIC programs always start in the same place in the Apple's memory, and thus can simply be SAVED, machine language programs can start at various places in memory. For this reason, the command to save a machine language program (BSAVE) must include the starting address (A) and the length (L) of the program being saved. For the program above, the command:

BSAVE RINGER,A\$300,L\$C

would be used. (The dollar sign (\$) signifies that the number is given in hexadecimal notation.)

You can now run this program by typing BRUN RINGER. (The address and length are only necessary for the BSAVE command.) You can also run this program from the disk/BASIC level (after you have BLOADED it into memory) with a CALL statement followed by the decimal equivalent of the starting address. In this case, CALL 768 can be used to run the program since 768 is the decimal form of the number \$300.

Sometimes a machine language listing is not a program at all, but is merely a table of data (such as a Hi-Res graphics shape table). In these cases, the memory addresses and their contents should be typed in as described above, but you should not attempt to BRUN the file you have saved. You will be able to determine whether the machine language listing is a program or a data table by reading the accompanying article.

As with Applesoft programs, MicroSPARC's KEY PERFECT program can help you find typing errors in machine language programs. Also, the Nibble program M.L.E. (Machine Language Editor) can simplify the entry and editing of machine

language programs. (See the Nibble software catalog in the back of this issue for details.)

We hope that Nibble will provide you with useful, interesting software, and that your efforts to type in and customize the program listings will help you become more familiar with your Apple. Please feel free to let us know what's working for you, and how you think we could be even more helpful. We'd love to hear from you!

DISK OPERATING SYSTEMS

A disk operating system is a powerful program that allows a computer to communicate with devices which are hooked up to it, such as disk drives, printers, and even the keyboard and video display. There are two different disk operating systems for the Apple II, //e and //c: DOS 3.3 and ProDOS. While DOS 3.3 will run on any Apple II, ProDOS will only work on an Apple II Plus that has an extra 16K of RAM or an Apple //e or //c.

Although there are many similarities between the two operating systems, there are enough differences that some programs which work properly under one system, will not work under the other. Whenever possible, the programs published in Nibble will be written in such a way that they will work properly under both DOS 3.3 and ProDOS. You will be able to tell if this is the case by reading the section that contains author information on the first page of each article.

For more information about DOS 3.3 and ProDOS, check with your local Apple dealer or user's group.

In this issue, good programs for beginners appear in the One-Liners section on page 160.

The Pain of Entering Machine Language Programs

STOP!

Let's face it...typing machine language programs from magazines and books is a pain! And if you make an error or leave something out, you may have to go back and retype the whole thing!

The NIBBLE MACHINE LANGUAGE EDITOR (MLE) uses word processing techniques to make the TYPING much easier. Automatic formatting and carriage returns do the job!

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TURTLE BASIC

by J.B. Ward

FEATURE ARTICLE

Add Logo-like commands to Applesoft for fast, easy turtle graphics programming. Turtle BASIC adds 24 keywords that let you control the “turtle,” print Hi-Res text, and create animation.

“Once” said the Mock Turtle at last, with a deep sigh, “I was a real Turtle.”* If your idea of a turtle is a short, slow, green reptile in a shell, you have not discovered the mock turtle of the modern age — turtle graphics. Turtle graphics is a concept that was developed as part of the Logo computer language. Logo’s inventors felt that understanding of graphics programming could be improved if students could visualize moving an object around the screen, commanding it to move a certain distance or face a particular direction. To reinforce the point, they devised a simple

robot (which looked a bit like a turtle) that could be programmed to move in the same way as the graphics cursor.

Turtle BASIC (Listings 1-4) modifies Applesoft to implement turtle graphics commands. Special keywords, such as FWD, BACK, LEFT and RIGHT, direct the turtle (or Hi-Res cursor) around the screen, while other keywords allow you to easily display Hi-Res text and create page-flip animation. Turtle BASIC is fast, and it eliminates the need for most shape tables and HPLOT statements.

WHY A TURTLE?

There are two ways to draw a line on the Apple. One is to specify two sets of x,y coordinates and draw a line that connects them. This is called the

**Alice in Wonderland* by Lewis Carroll.

J.B. Ward, Saint John, N.B., Canada. Turtle BASIC requires 64K and works only under DOS 3.3.



TABLE 1: List of Turtle BASIC Commands

Command	Description
FWD	Moves the turtle forward
BACK	Moves the turtle back
LEFT	Rotates the turtle's heading to the left
RIGHT	Rotates the turtle's heading to the right
JUMP	Moves the turtle to a specified position or series of positions
NEST	The upper-left corner of the screen
CENTER	The center of the screen (135,96)
TURNTO	Sets the turtle's angular heading
SHOW	Makes the turtle draw
HIDE	Makes the turtle stop drawing
HIRES	Selects Hi-Res graphics mode
TEXT	Selects text mode
SPLIT	Selects split graphics/text mode
FULL	Selects full-screen graphics
VIEW#	Selects Hi-Res page to view
PLT#	Selects Hi-Res page on which to plot
BLACK	Changes turtle color to black
WHITE	Changes turtle color to white
CLR	Clears the screen
DO	Subroutine call that allows a name
!	A REMark statement
TURTLEX	Current turtle x-coordinate (read only)
TURTY	Current turtle y-coordinate (read only)
ANGLE	Current turtle heading (read only)

Cartesian method, named for Rene Descartes. Another way (the turtle graphics way) is to say, "Turn left or right so many degrees and then go forward so many steps." Often, graphics that are difficult to draw using the Cartesian method become very simple using the turtle. Turtle BASIC lets you choose either method.

TALKING TURTLE

Before you can use the turtle, you need to learn its language. A complete list of the Turtle BASIC command set is shown in Table 1. The section PLAYING TURTLE leads you through a short sample session of programming in Turtle BASIC.

Moving the Turtle

The most basic keywords tell the turtle how to move. They are:

1. FWD *n* moves the turtle forward *n* units.
2. BACK *n* moves the turtle back *n* units.
3. LEFT *d* turns the turtle left *d* degrees.
4. RIGHT *d* turns the turtle right *d* degrees.

In these commands the *n* is specified in steps. The Hi-Res screen is 280 of these units wide and 192 high. The *d* represents an angle in degrees. Both *n* and *d* may be expressions. For instance:

```
100 FWD 5 : LEFT 90
```

moves the turtle forward five units, and then turns it 90 degrees counterclockwise. But the following statements are also handled properly:

```
100 FWD A + 5 * SQRT(Z1) : LEFT DQ * 2.3
```

The turtle graphics keywords follow the same rules as Applesoft BASIC keywords. Turtle BASIC uses the same Hi-Res coordinate system as Applesoft, so HPLLOT and DRAW can be used in the same program as Turtle BASIC commands.

Making the Turtle Visible

SHOW makes the turtle visible. When the turtle is visible, it draws on the screen as you move it around. HIDE makes the turtle invis-

ible. When the turtle is invisible, no lines are drawn when you move it around.

Orienting the Turtle

The JUMP command moves the turtle to a particular position or series of positions. Each position is specified by its *x,y* coordinates. A line may or may not be drawn, depending upon the pen color, SHOW/HIDE status and the exact syntax used. JUMP is similar in meaning to Applesoft's HPLLOT. Multiple arguments are possible, with each set of coordinates separated by the keyword TO. The following are examples of JUMP statements:

JUMP *x,y* — Positions the turtle at coordinates *x,y*. Using this syntax does not draw a line from the previous position to *x,y*, regardless of the SHOW/HIDE status. This takes care of the common case where a figure must be drawn, but the turtle is not at the starting point.

JUMP TO *x,y* — Draws a line between the previous position and *x,y*, if the turtle is in SHOW mode.

JUMP *x1,y1* TO *x2,y2* TO *x3,y3* — Draws a line from *x1,y1* to *x2,y2*, then to *x3,y3*.

JUMP TO *x1,y1* TO CENTER TO *x2,y2* TO NEST — Draws a line from the previous position to *x1,y1*, then to the center of the screen, then to *x2,y2*, then to the screen origin. Note that CENTER and NEST are keywords (discussed below).

TURNTO *d* — Turns the turtle to a heading of *d* degrees. Zero degrees points horizontally to the right. A positive angle is clockwise. The heading used here is an absolute heading, while the headings used by RIGHT and LEFT are relative to the current heading.

CENTER — Puts the turtle at the center of the screen (*x,y* = 140,96). A line is not drawn from the previous position. CENTER may be used by itself or as part of a JUMP command.

NEST — Puts the turtle at the origin in the upper-left corner of the screen (*x,y* = 0,0). As with CENTER, a line is not drawn. NEST may be used by itself or as part of a JUMP command.

Hi-Res Screen Control

The Applesoft keywords HGR and HGR2 are replaced in Turtle BASIC by more flexible keywords that control the Apple video software switches directly from BASIC. Each switch can be independently manipulated so that page-flip animation is made easy.

HIRES — Selects Hi-Res graphics mode. HIRES has no effect on the split/full mode setting or the screen selected for plotting and viewing (see below).

TEXT — Selects text mode, page 1. Switching to text mode does not disturb plotting to either Hi-Res page.

SPLIT — Selects the split (or mixed text and graphics) Hi-Res mode on the screen currently selected for viewing. This allows the bottom four lines of the text screen to be displayed on the Hi-Res screen. SPLIT is very useful when you are experimenting with immediate mode turtle commands.

FULL — Selects the full (unmixed) Hi-Res display mode.

VIEW# *n* — Selects a page for viewing. This may or may not be the same page currently selected for plotting. If *n* is odd, page 1 is selected; otherwise, page 2 is selected. The value of *n* must be greater than -32769 and less than 32768.

PLT# *n* — Selects a Hi-Res page for plotting. If *n* is odd, page 1 is selected; if *n* is even, page 2 is selected.

CLR — Clears the plotting page and fills it with the opposite of the currently selected turtle color (either black or white).

BLACK and WHITE — Specify the color of the turtle. **WHITE** is the default color, and will cause the turtle to draw white lines on a black background. **BLACK** has the opposite effect. Note that turtle graphics are monochromatic: if a bit on the screen is on, it is considered white, regardless of how it may appear on a color monitor.

Hi-Res Printing

HPRINT is simply a high resolution version of the Applesoft **PRINT**. The only difference in syntax is that **HPRINT** accepts a set of *x,y* coordinates as input arguments. These coordinates specify the position of the upper-left corner of the first character to be printed. In the following examples, *list* is any set of string or numeric expressions that would be acceptable to Applesoft's **PRINT**. Upper-case and lower-case characters are included in the Hi-Res character set. As usual, *x* and *y* represent a set of coordinates.

HPRINT (*x,y*) *list* — Prints a *list* starting at *x,y*. A carriage return is performed at the end of the print.

HPRINT *list* — Prints a *list* at the current text position on the screen. If this is followed by an **HPRINT (*x,y*) *list*** statement, the first character in the *list* would be at coordinates 0, *y*+8, that is, at the beginning of the next line.

HPRINT (*x,y*) *list* ; — As with **PRINT**, a semicolon eliminates the carriage return at the end of output. If an **HPRINT *list*** statement followed this one, the second output string would begin immediately after the end of the first.

HPRINT (*x,y*) ; — Sets up a starting position for some future **HPRINT**.

HPRINT — Performs a carriage return.

HPRINT ; — Does nothing.

System Variables

Three special keywords — **TURTLEX**, **TURTLEY** and **ANGLE** — provide information about the status of the turtle. They act like variables that cannot be assigned a value directly. Unlike Applesoft variable names, where only the first two characters are significant, all characters of these names are significant. **TURTLEX** and **TURTLEY** supply information about the position of the turtle, while **ANGLE** supplies the heading. For instance, to get the current turtle heading, you could just type:

```
PRINT ANGLE
```

or you could assign the value to a variable:

```
TH = ANGLE
```

but you cannot assign a value to **ANGLE** or expect to change the current heading with a statement such as:

```
ANGLE = 45
```

In this case, the BASIC variable **AN** gets the value 45 and the turtle heading does not change. **CURSORSX** and **CURSORY** can be used in the same way as **ANGLE**.

Miscellaneous Keywords

DO *name* — Is an extra type of subroutine call that is similar to **GOSUB** but accepts variable names. The variable must contain the

TABLE 2: Character Table for the Letter E

Table Offset (dec, hex)	Hex Table Address	Bit Pattern	Hex Value	Dec Value
296, \$128	\$92F0	00111110	\$3E	62
297, \$129	\$92F1	00000010	\$02	2
298, \$12A	\$92F2	00000010	\$02	2
299, \$12B	\$92F3	00011110	\$1E	30
300, \$12C	\$92F4	00000010	\$02	2
301, \$12D	\$92F5	00000010	\$02	2
302, \$12E	\$92F6	00111110	\$3E	62
303, \$12F	\$92F7	00000000	\$00	0
 (always 0)				

line number of the subroutine being called.

This new statement improves program readability. **GOSUB SQUARE** beats **GOSUB 2000** for readability, but a simple **DO SQUARE** is even better. When using **DO**, try to keep all variable definitions together, near the beginning of the program. This helps you keep track of your subroutine locations, and it speeds program execution, since the BASIC interpreter has fewer program lines to search through to find the value.

Exclamation Mark (!) — Substitutes for the **REM** statement. Like **DO**, it helps make programs more readable. The old **REM** has been left intact, and may still be used.

Custom Character Sets

Since the character set used by **HPRINT** is kept in RAM, it is possible to change individual characters in a set, or substitute another character set of your own. The character table is an array 96 characters long, with eight bytes per character. The address of the beginning of this table is at location \$8A8B (decimal 35467). Using an instruction sequence such as:

```
1000 PRINT CHR$(4); "BLOAD CSET2,A24576"
1010 POKE 35467,24576-INT(24576/256)*256
1020 POKE 35468,24576/256
```

would allow you to switch to a new character set kept at \$6000 (24576). After that, you could switch back and forth using only two **POKE** instructions.

To go back to the default character set, use:

```
POKE 35467,200 : ! Low byte address,$C8
POKE 35468,145 : ! High byte address,$91
```

Because the starting address of the default set is \$91C8 (decimal 37320), breaking \$91C8 into two bytes gives \$C8 (decimal 200) and \$91 (decimal 145).

The table starts with the space character, \$20, and ends with the rubout character (a solid block), \$7F. Since each character is represented by eight bytes, the first eight bytes define a space, the next eight define an exclamation mark (!), and so on.

The offset into the table for the letter E is given by:

OFFSET = 8*(ASC("E")-32)

which equals decimal 296.

Table 2 gives the bit pattern for the letter E. Wherever a bit is set to one, a pixel on the Hi-Res screen is lit. You can see that the bit patterns must be backwards. Less obvious is that while the bit patterns are all eight bits wide, a character on the screen is only seven bits wide. Bit 7 of each byte is never used, and should be left clear.

Your new character set can be made of graphic symbols or alphabetic characters. Large, complex symbols can then be made by put-

ting a number of characters together; each character is a piece of the larger symbol.

PLAYING TURTLE

Perhaps the best way to get the feel of turtle graphics programming is to try it in immediate mode, so you can see the effect on the screen as you enter each command. Start by initializing Turtle BASIC with:

```
BRUN TURTLE  
NEW
```

Then enter a very short program:

```
10 FWD 50 : LEFT 90  
20 END
```

Set up the Hi-Res, split screen for both viewing and plotting; clear it; and move the turtle to the center of the screen as follows:

Finally, you can label your creation with:

```
HPRINT (10,50) "SQUARES"
```

The two-line program simply draws a side of the square and turns the turtle 90 degrees to the left. See the demonstration programs (Listings 5, 6 and 7) for examples of incorporating these and other commands into a program. DEMO 1 uses a subroutine that draws a square in a manner very similar to what you just did in immediate mode. (See Figure 1 for the resulting display.) DEMO2 demonstrates the use of subroutines to create complex figures on both graphics pages, and then uses the VIEW command to achieve page-flip animation (Figure 2). Notice the use of Hi-Res text to include a prompt on the Hi-Res screen. DEMO3 uses simple turtle graphics commands to create an abstract pattern.

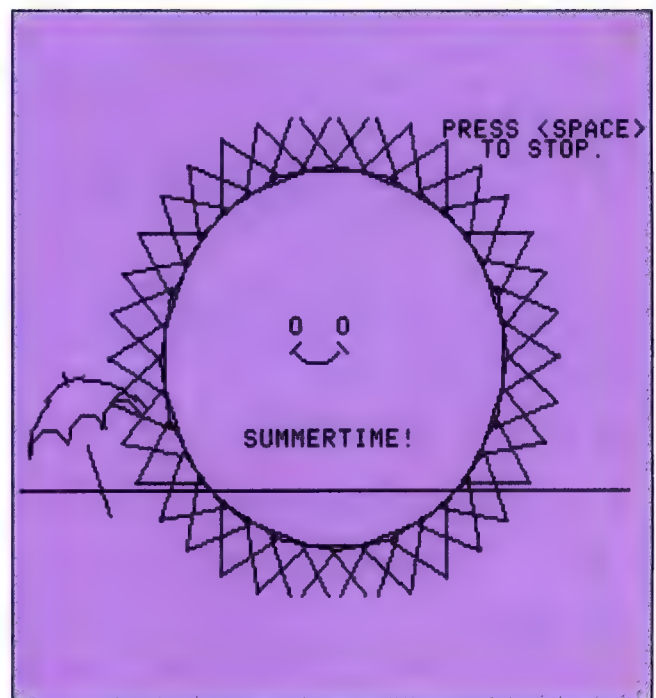
ENTERING THE PROGRAMS

Turtle BASIC is listed in two different ways. The first is as source

FIGURE 1: Squirrel Created by DEMO1



FIGURE 2: Animation Display Created by DEMO2



```
VIEW# 1  
PLT# 1  
SPLIT : HIRES  
CLR  
CENTER : TURNT0 0
```

Now you can draw a square, one side at a time, by typing:

```
RUN  
RUN  
RUN  
RUN
```

By changing the heading, you can draw a new square tilted at 45 degrees:

```
LEFT 45  
RUN  
RUN  
RUN  
RUN
```

code for entry using MicroSPARC's Assembler (Listings 1, 2 and 3), and the second is as a hex dump of the assembled program (Listing 4). If you don't have the MicroSPARC Assembler, follow the directions for entering the program from the hex dump.

Entering the Program With the MicroSPARC Assembler

If you are using a one-drive system, use the FID program from your DOS 3.3 System Master disk to copy the file MACLIB.SOURCE from the MicroSPARC Assembler disk to the disk that will hold your other source files.

Using the Assembler's editor, enter Listing 1 and save it under the name TURTLE1. Next, enter Listing 2 and save it under the name TURTLE2. Finally, enter Listing 3 and save it under the name TURTMAC. These files will show up in the disk directory with a .SOURCE suffix, but you should not enter the suffix when saving or loading these files with the Assembler. Load TURTLE1 and assemble it. It will automatically call the other two source files. When the assembly is completed, the object file, TURTLE, will have been automatically saved on the disk.

Entering the Program From the Hex Dump

To key in Turtle BASIC without the MicroSPARC Assembler, enter the Monitor with CALL - 151 and type the hex code as shown in Listing 4. Save the program with the command:

BSAVE TURTLE, A\$8800, L\$CC8

Entering the Demonstration Programs

Because Turtle BASIC is an altered version of Applesoft, it should be initialized with the command BRUN TURTLE before any Turtle BASIC program is entered (or loaded from disk). Once this has been done, enter DEMO1 (Listing 5) and save it with the command:

SAVE DEMO1

Enter DEMO2 (Listing 6) and save it with the command:

SAVE DEMO2

Enter DEMO3 (Listing 7) and save it with the command:

SAVE DEMO3

For help in entering *Nibble* listings, see "A Welcome to New *Nibble* Readers" at the beginning of this issue.

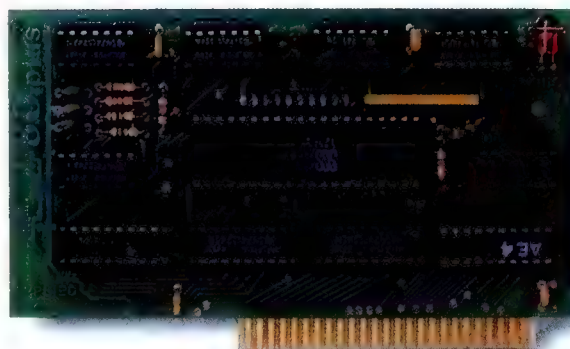
Turtle BASIC, Nibble Calculator and Tank Combat are available on diskette for an introductory price of \$19.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: TURTLE1 — Source File for MicroSPARC Assembler

```
0 :
1 : *****
2 : * TURTLE1 *
3 : * TURTLE.BASIC *
4 : * BY J.B. WARD *
5 : * COPYRIGHT (C) 1986 *
6 : * BY MICROSPARC, INC *
7 : * CONCORD, MA 01742 *
8 : *****
9 : *
10 : * MICROSPARC ASSEMBLER
11 : *
12 : USE MACLIB, D1
13 : USE TURTMAC, D2
14 : UEN
15 : MUL
16 : Define BASIC entry points &
17 : page zero locations.
18 NEW EQU $D64B ; "New-workspace" routine
19 WARM EQU $E003 ; Warm-start entry
20 IEVAL EQU $E6F8 ; Evaluate-exp., return 1 byte.
21 FEVAL EQU $DD67 ; " " " " flt.pt.
22 SINE EQU $EFF1 ; sub: Sine
23 COSINE EQU $EFEA ; sub: Cosine
24 FLOAD EQU $EAF9 ; sub: load FACC1
25 FSAVE EQU $EB2B ; sub: save FACC1
26 FADD EQU $E7BE ; sub: flt.pt. add
27 FADHAF EQU $E7A0 ; sub: add 0.5 to FACC1
28 FSUB EQU $E7A7 ; sub: flt.pt. subtraction
29 FIX EQU $E10C ; sub: convert FACC1, fp-to-int.
30 FMPY EQU $E97F ; sub: flt.pt. multiply
31 FDIV EQU $EA66 ; sub: flt.pt. divide
32 INT EQU $EC23 ; sub: take int. part of FACC1
33 REM EQU $D9DC ; sub: "REM" action
34 GOTO1 EQU $D941 ; sub: "GOTO" action
35 CHKDEP EQU $D3D6 ; ???
36 NEXT EQU $D7D2 ; "perform-next-line" entry
37 DOSWRM EQU $9DD0 ; DOS3.3 warm-start entry
38 CHKRPA EQU $DEB8 ; sub: check & skip right-paren
39 CHKLPA EQU $DEBB ; sub: check & skip left-paren
40 CHKCOM EQU $DEBE ; sub: check & skip comma
41 CHKC EQU $DEC0 ; sub: check & skip chr. in Areg
42 CHKALF EQU $E07D ; sub: if Areg=letter, carry:=1
43 PRINT2 EQU $DAD5 ; sub: "PRINT" entry
44 ILLQTY EQU $F206 ; "illegal quantity" msg. entry
45 BELL EQU $FBDD ; sub: ring bell.
```

continued on next page

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LISTING 1: TURTLE1 *(continued)*

```

46 GETC2 EQU $00B1 : sub: get-next-nonblk-input-chr
47 GETC3 EQU $00B7 : sub: get-last-nonblk-input-chr
48 HRPAGE EQU $E6 : hires-plot page; $20 or $40
49 LASCHR EQU $B8 : &B9 : ptr. to last input char.
50 LINENO EQU $75 : BASIC executing line #.
51 CSWL EQU $36 : char.output vector, low
52 CSHW EQU $37 : " " " " ,high
53 GBASL EQU $26 : hires graphics base addr, low
54 GBASH EQU $27 : " " " " ,high
55 NTOKES EQU 19 : Number of new token types.
56 TOTOKE EQU 193 : "TO" token number
57 CENTOKE EQU $F2 : "CENTER" token number
58 NESTOKE EQU $F3 : "NEST" token number
59 : temp. plotting vars: "borrows" F.P.registers.
60 PMSK EQU $9D : "plot-mask"; dot to be plotted.
61 XOFSET EQU $9E : x byte-offset into hires screen
62 PTCTR EQU $A0 : point counter; # points to plot.
63 XSTRT EQU $A2 : starting x byte offset
64 MSKIX EQU $A3 : index into dot-mask table
65 : $A4 must not be touched, else sys goes strange.
66 TMPIXC EQU $A5 : temp.integer x-coord
67 TMPIYC EQU $A7 : temp.integer y-coord
68 INCVAL EQU $A9 : (When: TSTSUM := TSTSUM+INCVAL)
69 TSTSUM EQU $AB : (results in carry-set, then we)
70 : (change dependent coord by +-1.)
71 : (Else next pt. is on vert. or horiz.)
72 : (line from last point plotted.)
73 ORG $8800
74 : * Begin Patch BASIC, initialize, warm-start BASIC.
75 TURTLE JSR CPYROM : Copy rom-to-ram
76 JSR PATCH : Patch ram copy to enter turtle.
77 JSR NEW : Call BASIC "new" routine.
78 JSR SETMEM : Set himem & lomem.
79 JSR SETRAM : Set flags & capture reset vec
80 JMP WARM : Warm-start interpreter.
81 : Function jump table
82 : Function Token #
83 FNADRS ADDR FWD-1 : EC
84 ADDR BACK-1 : ED
85 ADDR LEFT-1 : EE
86 ADDR RIGHT-1 : EF
87 ADDR SHOW-1 : F0
88 ADDR HIDE-1 : F1
89 ADDR CENTER-1 : F2
90 ADDR NEST-1 : F3
91 ADDR HEAD-1 : F4
92 ADDR JUMPTO-1 : F5
93 ADDR SPLIT-1 : F6
94 ADDR FULL-1 : F7
95 ADDR HIRES-1 : F8
96 ADDR VIEW-1 : F9
97 ADDR EXCLAIM-1 : FA
98 ADDR DO-1 : FB
99 ADDR HPRINT-1 : FC
100 ADDR BLACK-1 : FD
101 ADDR WHITE-1 : FE
102 : Token names for turtle extensions
103 NAMES DCI FWD"
104 DCI BACK"
105 DCI LEFT"
106 DCI RIGHT"
107 DCI SHOW"
108 DCI HIDE"
109 DCI CENTER"
110 DCI NEST"
111 DCI TURNT0"
112 DCI JUMP"
113 DCI SPLIT"
114 DCI FULL"
115 DCI HIRES"
116 DCI VIEW#"
117 DCI "
118 DCI DO"
119 DCI HPRINT"
120 DCI BLACK"
121 DCI WHITE"
122 DFC 0
123 : Copy all of $D000-$FFFF from ROM to RAM
124 CPYROM LDY #0
125 STY $50
126 LDA #$D0
127 STA $51
128 LDA $C081 : enable read-rom/write-ram
129 CPY010 LDA ($50).Y
130 STA ($50).Y
131 INY
132 BNE CPY010
133 INC $51
134 BNE CPY010
135 RTS
136 : Patch RAM copy of interpreter to
137 : cause entry to turtle code
138 PATCH LDA #$4C : Put JMP opcode at
139 STA $D60B : 1) Parse patch
140 STA $D737 : 2) List patch
141 STA $D846 : 3) Run patch
142 STA $D5E5 : 4) Parser "I" patch
143 STA $D60C : 1) PARPAT/
144 LDA $D60D : 2) LISPAT
145 STA $D738 : 3) LISPAT/
146 STA $D739 : 4) RUNPAT
147 LDA $D847 : 5) RUNPAT/
148 STA $D848 : 6) REMPAT
149 LDA $D5E6 : 7) REMPAT/
150 STA $D5E7 : 8) VARPAT
151 LDA $DED6 : 9) VARPAT/
152 STA $DED7 : 10) DEX
153 LDX #6 : 11) PAT010
154 LDA NNS.X : 12) CLR" and "DRAW"
155 STA $D109.X : 13) DEX
156 LDA PAT010 : 14) BPL
157 STA $PLOT-1 : 15) PLOT-1
158 STA $D020 : 16) STA
159 LDA $PLOT-1/ : 17) LDA
160 STA $D021 : 18) STA
161 LDA $CLR-1 : 19) CLR-1
162 STA $D022 : 20) STA
163 LDA $CLR-1/ : 21) LDA
164 STA $D023 : 22) STA
165 LDA $TEXT-1 : 23) Change addr of TEXT
166 STA $D012 : 24) STA
167 LDA $TEXT-1/ : 25) LDA
168 STA $D013 : 26) STA
169 LDA $FFF : 27) allow lower-case input
170 STA $FD83 : 28) STA
171 LDY #5 : 29) fill in ext.exec.vectors
172 PAT020 LDA EXADRS.Y : 30) PAT020
173 STA EXLIAD.Y : 31) STA
174 DEY : 32) DEY
175 BPL PAT020 : 33) BPL
176 LDA $C080 : 34) Write-protect RAM above $D000
177 LDA $C080 : 35) LDA
178 RTS : 36) RTS
179 NNS DCI PLT#" : 37) NNS
180 DCI CLR" : 38) DCI
181 : Set high memory bound for interpreter
182 SETMEM LDA $TURTLE-1 : Himem=just below turtle
183 STA $73 : 39) STA
184 STA $6F : 40) STA
185 LDA $TURTLE-1/ : 41) LDA
186 STA $74 : 42) STA
187 STA $70 : 43) STA
188 RTS : 44) RTS
189 SETRAM LDA $FFF : 45) SETRAM
190 STA $E4 : 46) STA
191 LDA #0 : 47) LDA
192 STA SHOFLG : 48) Show' turtle
193 LDA $520 : 49) LDA
194 STA HRPAGE : 50) hires screen=1
195 JSR CENTER : 51) Center turtle
196 JSR WHITE : 52) Set ink = white
197 LDA #CHRTAB : 53) LDA
198 STA CTABAD : 54) Point hires print to
199 LDA #CHRTAB/ : 55) our hires char table
200 STA CTABAD+1 : 56) STA
201 LDA #RESET : 57) LDA
202 STA $3F2 : 58) STA
203 LDA #RESET/ : 59) Capture reset vector
204 STA $3F3 : 60) STA
205 EOR $A5 : 61) EOR
206 STA $3F4 : 62) STA
207 RTS : 63) RTS
208 *****
209 *** PATCHES ***
210 *****
211 Note "hooks" for future extensions to
212 keywords by inclusion of external code
213 EXADRS ADDR RETURN : default adrs for exec.
214 ADDR RETURN : vectors.below
215 ADDR RUN990 : 64) ADDR
216 DFS 2 : 65) DFS
217 EXPAAD DFS 2 : 66) EXT
218 EXRUAD DFS 2 : 67) EXEC
219 EXLIST JMP (EXLIAD) : 68) EXLIST
220 EXPARSE JMP (EXPAAAD) : 69) EXPARSE
221 EXRUN JMP (EXRUAD) : 70) EXRUN
222 RETURN RTS : 71) dummy" statement
223 : Reset patch
224 RESET LDA $C080 : Set lang card ram for read.
225 LDA $C080 : but write protected: Warm
226 JMP DOSWRM : start interpreter
227 : Program-list patch
228 LISPAT CMP $FF : double token?
229 BNE LIS010 : skip if not, else exec

```



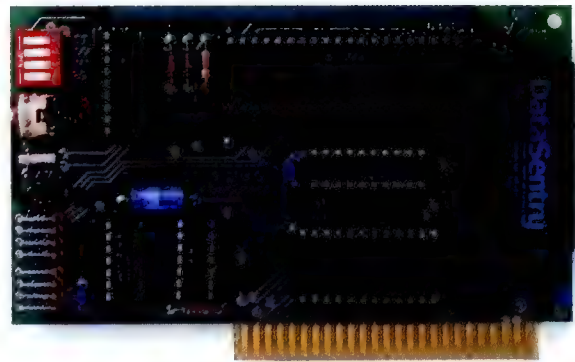
```

242      JSR    EXLIST      ;external code, if any.
243      BCC    LIS030      ;-br. if external token.
244 LIS010  CMP    #235      ;is it one of our tokens?
245      BCS    LIS020      ;:(branch if so.)
246      SBC    #57E        ;no.exec patched-over code&ret.
247      TAX
248      JMP    $D73A
249 LIS020  SBC    #235      ;Token probably ours.Point to
250      TAX          ;our name table,return to check.
251      STY    $85
252      LDA    #NAMES
253      STA    $9D
254      LDA    #NAMES-$100/
255      STA    $9E
256 LIS030  JMP    $D744
257 ; Parser patch
258 PARPAT  LDA    $0F        ;see if our keyword table
259      CMP    #233          ;has been checked yet.
260      BCC    PAR010        ;if not,branch; else exec.
261      JSR    EXPARSE       ;external code,if any.
262      BCC    PAR020        ;br. if found in ext.table.
263      LDA    $0200,X        ;-name not in our table either.
264      JMP    $D60E
265 PAR010  LDA    #NAMES-1    ;Have parser check
266      STA    $9D          ;our name table.
267      LDA    #NAMES-1/
268      STA    $9E
269 PAR020  LDY    #0
270      JMP    $D5A8
271 ; Run-time patch
272 RUNPAT  CMP    #$FF        ; double token?
273      BNE    RUN010        ;skip if not; else execute
274      JMP    EXRUN         ;some external code.
275 RUN010  SEC
276      SBC    #108          ;Is token one of ours?
277      CMP    #NTOKES
278      BCS    RUN990        ;Nope...must be an error.
279      ASL
280      TAY          ;Cvt.new token code to fn.table
281      LDA    FNADRS+1,Y    ;offset.addr will be popped and
282      PHA          ;used when "$00B1" routine does
283      LDA    FNADRS,Y      ;an RTS instruction.
284      PHA
285      JMP    $00B1
286 RUN990  JMP    $DEC9      ; - Syntax Error.
287 ; Patch for REMark alias, "!"
288 ; Patch parser to include check for "!"
289 ; immediately after check for "REM" fails.
290 REMPAT  BEQ    REM010      ; ( if token = REM )
291      CMP    #72          ; Not REM; how about
292      BEQ    REM010        ; alias, "!" ?
293      JMP    $D56D          ; -Was neither. Act nonchalant.
294 REM010  LDA    #0          ;Bingo. Token was either
295      STA    $0E          ;REM or !. We could care
296      JMP    $D5E9        ;less which; do REM action.
297 ; Patch to variable-name search routine
298 ; to allow use of "TURTLEX","TURTLEY",
299 ; and "ANGLE" as special system variables.
300 VARPAT  LDY    #6          ;check for "TURTLEX"
301 VP010   LDA    ($B8),Y
302      CMP    TXN,Y
303      BNE    VP020
304      DEY
305      BPL    VP010
306      LDX    #XC
307      LDY    #XC/
308      JMP    VP040
309 VP020   LDY    #6          ;check for "TURTLEY"
310 VP030   LDA    ($B8),Y
311      CMP    TYN,Y
312      BNE    VP050
313      DEY
314      BPL    VP030
315      LDX    #YC
316      LDY    #YC/
317 VP040   JSR    GETC2        ;skip over name.
318      BCC    VP040
319      JSR    CHKALF
320      BCS    VP040
321      LDA    #0
322      STA    $11          ;clear "string" flag
323      STA    $12          ;clear "integer" flag
324      TXA
325      JMP    $DED8
326 VP050   LDY    #4          ;check for "ANGLE"
327 VP060   LDA    ($B8),Y
328      CMP    ANN,Y
329      BNE    VP070
330      DEY
331      BPL    VP060
332      FDIV    THETA,PIBY180,FTMP
333      LDA    #FTMP
334      LDY    #FTMP/
335      JMP    VP040
336 VP070   JSR    $DFE3        ;not turtlex,y or angle.
337      JMP    $DED8          ;do normal search & return.
338 TXN     DFC    $54,$55,$52,$54,$4C,$45,$58
339 TYN     DFC    $54,$55,$52,$54,$4C,$45,$59

```

continued on next page

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LISTING 1: TURTLE1 (continued)

```

340 ANN      DFC      $41,$4E,$47,$4C,$45
341 TWOPI    DFC      $83,$49,$0F,$DA,$A1 ;PI*2
342 PIBY180  DFC      $7B,$0E,$FA,$35,$12 ;PI/180
343 INK       DFS      1          ;Turtle "colour";black or white
344 SHOFLG    DFS      1          ;Turtle "show/hide" flag
345 IXC       DFS      2          ;Turtle x-coord., integer
346 IYC       DFS      2          ;Turtle y-coord., integer
347 XC        DFS      5          ;Turtle X-coordinate,flt.pt.
348 YC        DFS      5          ;Turtle y-coord., flt.pt.
349 THETA     DFS      5          ;Directional angle
350 CTABAD    DFS      2          ;Hires-print char.table address
351 HPRX      DFS      2          ;Hires-print X-coord
352 HPRY      DFS      1          ;" Y-coord
353 CSWSAV    DFS      2          ;CSW (char.out.vec.) temp.save
354 DIST      DFS      5          ;Flt.pt. dist.var.for FWD/BACK
355 FTMP      DFS      5          ;Misc. FP.& int. scratch vars
356 FTMP2     DFS      5
357 PINC      DFS      5          ;Plot-increment
358 DX        DFS      5          ;Plot delta-x
359 DY        DFS      5          ;Plot delta-y
360 XDIR      DFS      1          ;X-direction; + or -
361 YDIR      DFS      1          ;Y-direction; + or -
362 X1TMP     DFS      2
363 Y1TMP     DFS      2
364 X2TMP     DFS      2
365 Y2TMP     DFS      2
366 ; Get a character from source input line for
367 ; inspection, only. Do not increment pointer.
368 GETC1     LDY      #0
369          LDA      ($B8),Y
370          RTS
371 ; Wait for vertical sync. pulse.
372 ; Used to synchronize page swapping.
373 WAITVID   PHA
374 WVD010    LDA      $C019
375          BMI      WVD010
376          PLA
377          RTS
378 ; Get & evaluate expression in line.
379 ; Return a 16-bit value: A=lobyte, Y=hbyte.
380 EVAL      JSR      FEVAL
381          JSR      FIX
382          LDA      $A1
383          LDY      $A0
384          RTS
385 ; Set "colour" of turtle - draw with
386 ; black or white stroke.
387 ; Syntax: [ WHITE ] [ BLACK ]
388 ; Set ink = white
389 WHITE     LDA      #0
390          STA      INK
391          RTS
392 ; Set ink = black
393 BLACK     LDA      #$FF
394          STA      INK
395          RTS
396 ; Move turtle forward or backward.
397 ; Syntax: [ FWD <exp> ] [ BACK <exp> ]
398 ; Where <exp> is any valid algebraic expression
399 BACK      FEVAL DIST
400          CHS      DIST
401          JMP      BANDF
402 FWD       FEVAL DIST
403 BANDF     FLOAD THETA
404          JSR      COSINE ;tmp := cos(theta)
405          FMPY DIST ;tmp := d*cos(theta)
406          FSAVE DX ;( save delta-x )
407          FADD XC ;tmp.xc = c+d*cos(theta)
408          FSAVE FTMP
409          FLOAD THETA
410          JSR      SINE
411          FMPY DIST
412          FSAVE DY
413          FADD YC
414          FSAVE FTMP2
415          JSR      DRAWLIN ;x plot a line *
416          RTS
417 ; Turn turtle left or right, or
418 ; head in some direction.
419 ; Syntax. [ LEFT <deg> ] [ RIGHT <deg> ]
420 ; [ TURNTO <deg> ]
421 ; <deg> specifies angle in degrees.
422 HEAD      FEVAL THETA
423          FMPY PIBY180
424          JMP      MOD2PI
425 LEFT      FEVAL FTMP
426          CHS      FTMP
427          FLOAD FTMP
428          JMP      LANDR
429 RIGHT     FEVAL FTMP
430          FMPY PIBY180
431          FADD THETA
432 MOD2PI    FSAVE FTMP
433          FLOAD TWOPI
434          FDIV FTMP
435          JSR      INT
436          FMPY TWOPI
437          FSUB FTMP
438          FSAVE THETA
439          RTS
440 ; Show turtle
441 SHOW      LDA      SHOFLG
442          AND      #$7F
443          STA      SHOFLG
444          RTS
445 ; Hide turtle
446 HIDE      LDA      SHOFLG
447          ORA      #$80
448          STA      SHOFLG
449          RTS
450 ; For HIRES,TEXT,SPLIT,FULL:
451 ; Syntax: [ name ] ... No parameters
452 HIRES     JSR      WAITVID
453          LDA      $C050 ;graphics
454          LDA      $C057 ;hires
455          RTS
456 TEXT      JSR      WAITVID
457          LDA      $C051 ;text
458          LDA      $C054 ;page 1
459          RTS
460 SPLIT     JSR      WAITVID
461          LDA      $C053
462          RTS
463 FULL      JSR      WAITVID
464          LDA      $C052
465          RTS
466 ; Select hires screen for display
467 ; Syntax: [ VIEW# <exp> ] ... If <exp>
468 ; is odd, select screen1; else screen2.
469 VIEW      JSR      EVAL
470          JSR      WAITVID
471          LSR
472          BCS      PAGE1
473          LDA      $C055 ;select page 2
474          RTS
475 PAGE1     LDA      $C054
476          RTS
477 ; Select hires screen for plotting
478 ; Syntax: [ USE# <exp> ] ... if <exp>
479 ; is odd, select screen1; else screen2.
480 PLOT      JSR      EVAL
481          LSR
482          BCS      PLOT1
483          LDA      #$40
484          STA      HRPAGE
485          RTS
486 PLOT1     LDA      #$20
487          STA      HRPAGE
488          RTS
489 ; Clear the hires screen presently
490 ; selected for plotting.
491 ; Syntax: [ CLR ]
492 CLR       CLC
493          LDA      #$1F
494          TAX
495          ADC      HRPAGE
496          STA      GBASH
497          LDA      #0
498          LDY      #$FF
499          STA      GBASL
500          BIT      INK
501          BVC      CLR10
502          TYA
503 CLR10     STA      (GBASL),Y
504          DEY
505          BNE      CLR10
506          STA      (GBASL),Y
507          DEC      GBASH
508          DEX
509          BPL      CLR10
510          RTS
511 ; Put turtle at centre of screen, or
512 ; at origin
513 ; Syntax [ CENTER ] [ NEST ]
514 CENTER    LDX      #9
515 CEN010    LDA      CCORDS,X
516          STA      XC,X
517          DEX
518          BPL      CEN010
519          LDX      #3
520 CEN020    LDA      ICORDS,X
521          STA      IXC,X
522          DEX
523          BPL      CEN020
524          RTS
525 CCORDS    DFC      $88,$0C,$00,$00,$00 : 140.0
526          DFC      $87,$40,$00,$00,$00 : 96.0
527 ICORDS    ADDR      140
528          ADDR      96
529 NEST      LDX      #9
530          LDA      #0
531 NES010    STA      XC,X
532          DEX
533          BPL      NES010
534          LDX      #3

```




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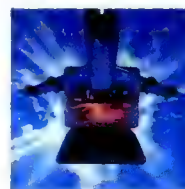
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CIRCLE NUMBER 8

LISTING 2: TURTLE2 — Source File for MicroSPARC Assembler

```

0:
1: *****
2: *      TURTLE2      *
3: *      TURTLE BASIC  *
4: *      BY J.B. WARD  *
5: *      COPYRIGHT (C) 1986 *
6: *      BY MICROSPARC, INC *
7: *      CONCORD, MA 01742 *
8: *****
9:
10: Print a line to hires screen.
11: Syntax: [ HPRINT(x,y) ...line... ]
12:         [ HPRINT ...line... ]
13: Where: "...line..." is any line
14: description valid for the "PRINT"
15: statement, except for use of "TAB(n)".
16: x & y are the hires XY coords of the
17: upper left hand corner of the 1st
18: character printed.
19 HPRINT JSR GETC1 ;Get next char...
20 CMP #28 ;If it's not "(", assume no
21 BNE HPR030 ;xy coords are specified.
22 JSR GETC2 ;(throw left paren away)
23 FEVAL FTMP ; get x-coord
24 JSR CHKCOM ; comma?
25 FEVAL FTMP2 ; get y-coord
26 JSR CHKRPA ; right paren?
27 JSR CHKXY
28 LDA Y2TMP
29 STA HPRY
30 LDX #FFF ;"divide" X-coord by 7
31 LDA X2TMP
32 HPR010 INX
33 CMP #7 ;HPRX := int(x/7)
34 BCC HPR020 ;HPRX+1 := x mod 7
35 SBC #7
36 JMP HPR010
37 HPR020 STX HPRX
38 STA HPRX+1
39 HPR030 LDA CSWL ;Save character-output vector;
40 STA CSWSAV ;Replace it with our addr.
41 LDA CSWH
42 STA CSWSAV+1
43 LDA #HPRDRV
44 STA CSWL
45 LDA #HPRDRV/
46 STA CSWH
47 JSR GETC3
48 JSR PRINT2 ;***Call PRINT routine***
49 LDA CSWSAV
50 STA CSWL
51 LDA CSWSAV+1
52 STA CSWH
53 RTS
54 ; Fix & check x-y coords
55 CHKXY FIX FTMP, X2TMP
56 FIX FTMP2, Y2TMP
57 LDA X2TMP+1
58 BEQ CXY10 ; -1<x<280 ?
59 CMP #2
60 BCS CXY999
61 LDA X2TMP
62 CMP #280
63 BCS CXY999
64 CXY10 LDA Y2TMP+1 ; -1<y<192 ?
65 BNE CXY999
66 LDA Y2TMP
67 CMP #192
68 BCS CXY999
69 RTS
70 CXY999 JMP ILLQTY ;("Illegal Quantity")
71 ; Hires-print character output driver
72 HPRDRV STA $D0
73 PHA
74 TXA
75 PHA
76 TYA
77 PHA
78 LDA $D0
79 AND #$7F
80 CMP #$20
81 BCS HDR015
82 CMP #$0D ;Carriage-return?
83 BNE HDR010
84 JSR HICR
85 JMP HDR030
86 HDR010 CMP #7 ;Bell character?
87 BNE HDR015
88 JSR BELL
89 JMP HDR030
90 HDR015 SBC #$20
91 STA $D0
92 LDA #0
93 ASL $D0
94 ROL
95 ASL $D0
96 ROL

```

continued on page 29

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128K RAM Card RAM Disk!**

The JE868 is functionally compatible with the Apple II language card and can be utilized with all software that can be used with a standard 16K card. The JE868 requires no modifications to your Apple computer. Five key software programs are included: Memory Management System, utilities, diagnostics, demos, and RAM disk emulators for DOS 3.3, CP/M and Apple Pascal. Also features DOS relocater. Complete with instructions.

JE868 (Expand-A-RAM) . . . \$119.95

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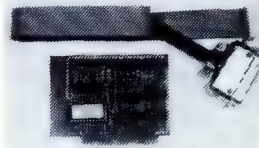


Applesurance Diagnostic Disk Controller Card

The JE877 serves as a diagnostic tool, an assurance/maintenance tool and a dual disk drive controller. The JE877 will verify and check the operating hardware of your system each time you turn on your Apple II, II+ or IIe.* Test your RAM, ROM, CPU, and disk drives. Diagnostic routines may be cancelled at the touch of a key. Complete with instructions.

JE877 (DRV-1/Applesurance II) . . . \$69.95

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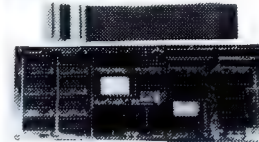


Parallel Printer Card

The JE880 Printer Interface board is an intelligent interface to most of today's popular dot-matrix graphics printers. The JE880 is fully compatible with Apple CP/M, Apple Pascal (or FORTRAN), and most other operating systems and software packages available for Apple II, II+ and IIe.* The JE880 is shipped configured for the Centronics standard and can be re-configured for other standards if necessary. Advanced text printing features include: video screen echo ON or OFF, auto/disable linefeed after carriage return, set/clear the 8th bit of the output data, set left margin and more! Complete with instructions.

JE880 (PRT-1). \$59.95

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JE883 (P/S Buffer). \$79.95

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APPLE™ Compatible 5 1/4" Disk Drive and Controller Card

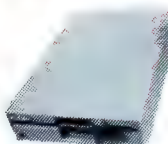


- Belt-driven • 143K formatted storage
- Color matches Apple Computer
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- Complete with connector — just plug into your disk controller card
- 35 tracks • Size: 6"W x 3 1/2"H x 8-9/16"D • Weight: 4 1/4 lbs.

ADD-514 (Disk Drive) \$139.95

JE875 (Controller Card) \$49.95

APPLE™ Compatible 5 1/4" Half-Ht. Disk Drive



- Direct drive • 143K formatted • 35 tracks • Super quiet • Works with Apple Controllers or other compatibles (JE875) above
- Complete with connector—just plug into your controller • Size: 5 1/4"W x 1 1/2"H x 8"D • Weight: 4 lbs.

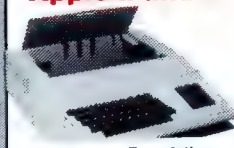
ADD-12. . . \$129.95

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- Same specs as ADD-12 (above) except no controller necessary.

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Part No.	Description	Price
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KB-A68	68-Key Apple Keyboard only.	\$69.95
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KEYBOARD (KB-A68):

- 68 Keys • 15-Key Keypad • Direct connection with 16-pin ribbon connector
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- Accommodates KB-A68 • Pop-up lid for easy access • Fits power supply and motherboard • Size: 15 1/2"L x 18"D x 4 1/4"H

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for any RS232 Computer
PM1200 (Stand-Alone) \$299.95

MAC PAC for your Macintosh

Includes: ProModem 1200 external modem, cable and ProCom-M software.

MAC PAC . . . \$349.95

OPTIONS for PM1200/MAC PAC

PM-Special #2 Includes Comm. Buffer, 512K Memory and Display. \$249.95

1200/300 Baud 212A Telephone Modem for your Apple II, II+ & IIe. Just plug in — Hayes compatible!
PM1200A . . . \$299.95

300 Baud for IIc Attaches to the rear of Apple IIc. Built-in speaker.
PM300c. . . \$149.95

**When using CP/M, the JE860 and JE868 will only function with Versions 2.20 or earlier.

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Nibble Express Volume VI is the biggest collection of Apple programs we've ever published! Express VI is 288 pages packed with over \$600* of ready-to-type Apple programs from Nibble Magazine 1985.

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APPLESOFT SUPERCHARGER powers your Apple with a set of machine language utilities to format output, control user input, chain programs with common variables, and much more.

SPOOLER keeps your printer busy while you keep computing. It uses the 16K RAM card area to store printer output as you work under DOS 3.3.

Education:

NIBBLE PLANETARIUM is a Hi-Res star charting system with the features of a real planetarium. Display and print the sky from any location in the Northern Hemisphere and at any time.

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THE NIBBLE 500 challenges you to race for glory through a curving track with random obstacles and a pit stop.

PENGUIN is an arcade-style strategy game with increasing skill levels. Help Sammy the Penguin fend off the invaders to his little island!

LISTING 2: TURTLE2 (continued)

```

97     ASL     $D0
98     ROL
99     STA     $D1
100    LDA     $D0
101    ADC     CTABAD
102    STA     $D0
103    LDA     $D1
104    ADC     CTABAD+1
105    STA     $D1
106    LDA     HPRX
107    STA     X1TMP
108    LDY     #7           ;Loop 8 times to put all 8
109    STY     Y2TMP         ;rows of character to screen.
110 HDR020 JSR     HPRADR     ;(get screen address)
111     JSR     HPRPUT       ;(put char.r row to scrn)
112     DEC     Y2TMP
113     BPL     HDR020
114     INC     HPRX         ;Increment char.position
115     LDA     HPRX
116     CMP     #40          ;If at end-of-screen,
117     BCC     HDR030       ;do a <cr> action.
118     JSR     HICR
119 HDR030 PLA
120     TAY
121     PLA
122     TAX
123     PLA
124     RTS
125 ; Do a hires carriage-return action
126 HICR   LDA     #0
127     STA     HPRX
128     CLC
129     LDA     HPRY
130     ADC     #8
131     CMP     #185
132     BCC     HIC010
133     LDA     #0
134 HIC010 STA     HPRY
135     RTS
136 ; Get byte address in hires screen
137 ; for one hires character.
138 HPRADR CLC
139     LDA     HPRY
140     ADC     Y2TMP
141 HPRYAD LDX     #0           ;Entry for lineplot y-adr
142     STX     GBASH
143     TAX
144     AND     #$38
145     ASL
146     ASL
147     ASL
148     ROL     GBASH
149     ASL
150     ROL     GBASH
151     STA     GBASH
152     TXA
153     AND     #$C0
154     LSR
155     STA     X1TMP+1
156     LSR
157     LSR
158     ORA     X1TMP+1
159     ORA     GBASH
160     ADC     X1TMP
161     STA     GBASH
162     TXA
163     AND     #$07
164     ASL
165     ASL
166     ORA     GBASH
167     ADC     HRPAGE
168     STA     GBASH
169     RTS
170 ; Put one line of a character to screen.
171 ; characters are permitted to cross the
172 ; 40 "character column" boundaries.
173 HPRPUT LDY     Y2TMP
174     LDA     ($D0),Y       ;get line of char.
175     LDY     #0
176     LDX     HPRX+1
177     BEQ     HPU020        ;if char.doesnt cross bound.
178     STY     $9D           ;char. does cross...
179 HPU010 ASL           ;align to span 2 adrs.
180     ROL     $9D
181     DEX
182     BNE     HPU010
183     ASL
184     ROL     $9D           ;adjust for colour bit (bit7)
185     LSR
186     JSR     PUTCHR        ;put to screen
187     LDX     HPRX
188     CPX     #39           ;test for RHS of screen.
189     BCS     HPU030
190     INY
191     LDA     $9D
192 HPU020 JSR     PUTCHR        ;put to screen

```

```

193 HPU030 RTS
194 ; *****
195 ; * PLOTTING ROUTINES *
196 ; *****
197 DRAWLIN LDA     #XC       ;Fix turtle x,y ;If new x,y
198     LDY     #XC/         ;differs from last-plotted x,y
199     JSR     FLOAD        ;by less than 2, then use last
200     JSR     FADHAF       ;plotted x,y to start.
201     JSR     FIX          ;Else use new.
202     SEC
203     LDA     $A1
204     SBC     IXC
205     BPL     DRL10        ; (take abs value)
206     EOR     #$FF
207     CLC
208     ADC     #1
209 DRL10   CMP     #2
210     BCC     DRL20        ;if abs(newx-lastx) >= 2, then:
211     LDA     $A0          ;IXC := fix(XC)
212     STA     IXC+1
213     LDA     $A1
214     STA     IXC
215 DRL20   LDA     #YC
216     LDY     #YC/
217     JSR     FLOAD
218     JSR     FADHAF
219     JSR     FIX
220     SEC
221     LDA     $A1
222     SBC     IYC
223     BPL     DRL30
224     EOR     #$FF
225     CLC
226     ADC     #1
227 DRL30   CMP     #2
228     BCC     DRL40
229     LDA     $A0          ;IYC := fix(YC)
230     STA     IYC+1
231     LDA     $A1
232     STA     IYC
233 DRL40   FIX     FTMP,X1TMP
234     FIX     FTMP2,Y1TMP
235     LDX     #4
236 DRL50   LDA     FTMP,X       ;Update turtle x,y
237     STA     XC,X
238     LDA     FTMP2,X
239     STA     YC,X
240     DEX
241     BPL     DRL50
242     JSR     LPL0T
243     LDX     #3
244 DRL60   LDA     TMP1XC,X
245     STA     IXC,X
246     DEX
247     BPL     DRL60
248     RTS
249 ; Plot a line on hires screen
250 LPL0T   LDA     #0
251     STA     X1TMP
252     LDA     DX+1
253     STA     XDIR          ;Save sign of dx,dy
254     LDA     DY+1
255     STA     YDIR
256     ABS     DX            ;See if magnitude of dx
257     ABS     DY            ;is greater or less than mag.dy
258     LDX     #0
259 PLT10   LDA     DX,X
260     CMP     DY,X
261     BNE     PLT20
262     INX
263     CPX     #5
264     BCC     PLT10        ;If (mag.dx) >= (mag dy), plot
265 PLT20   BCS     PLT30        ;y as a function of x; Else plot
266     JSR     FOFY          ;x as a function of y.
267     RTS
268 PLT30   JSR     FOFX
269     RTS
270 ;
271 ; Find "Y-address"
272 YADR    LDA     TMP1YC+1
273     BPL     YAD10
274     LDA     #0
275     JMP     HPRYAD
276 YAD10   BEQ     YAD20
277     LDA     #191
278     JMP     HPRYAD
279 YAD20   LDA     TMP1YC
280     CMP     #192
281     BCC     YAD30
282     LDA     #191
283 YAD30   JMP     HPRYAD
284 ; Find "x-address" ; offset into line & bitmask.
285 XADR    LDA     TMP1XC
286     STA     XSTRT
287     LDA     TMP1XC+1
288     STA     XSTRT+1
289     BPL     XAD10
290     LDA     #0           ;If x<0, then x := 0

```

continued on next page

LISTING 2: TURTLE2 (continued)

```

291 STA XSTRT
292 STA XSTRT+1
293 JMP XAD20
294 XAD10 SEC
295 LDA XSTRT ;If x>279 , then x := 279
296 SBC #279
297 LDA XSTRT+1
298 SBC #279/
299 BCC XAD20
300 LDA #279
301 STA XSTRT
302 LDA #279/
303 STA XSTRT+1
304 XAD20 ASL XSTRT ;Divide x by 7:Quotient is
305 ROL XSTRT+1 ;byte offset into line ;
306 LDY #7 ;Remainder is index into
307 LDA #0 ;bitmask table.
308 STA XOFSET
309 XAD30 DEY
310 BMI XAD40
311 ROL XOFSET
312 ASL XSTRT
313 ROL XSTRT+1
314 SEC
315 LDA XSTRT+1
316 SBC #7
317 BCC XAD30
318 STA XSTRT+1 ; * XSTRT = MSKIX *
319 BCS XAD30
320 XAD40 ROL XOFSET
321 RTS
322 ; Plot Y as a function of X.
323 FOFX LDA DX
324 BNE FOX20 ;Avoid possible div-by-zero.
325 LDX #4
326 FOX10 STA PINC,X
327 DEX
328 BPL FOX10
329 JMP FOX30
330 FOX20 FDIV DY,DX,PINC ;(dy/dx) used to determine
331 FOX30 LDA #DX ;when to inc.or dec.y-coord.
332 LDY #DX/
333 JSR PPREP
334 FOX40 JSR PUTBIT ; * plot a single point. *
335 JSR TSTCTR ; done ?
336 BNE FOX50 ; ( skip if more to do.)
337 RTS
338 FOX50 JSR TSTPINC ;Add test value to test sum;
339 BCC FOX60 ;Next point up or down 1 bit ?
340 JSR GNY ;yes. get-next-Y-address
341 FOX60 JSR GNX
342 JMP FOX40
343 ; Plot X as a function of Y
344 FOFY LDA DY
345 BNE FOY20
346 LDX #4
347 FOY10 STA PINC,X
348 DEX
349 BPL FOY10
350 JMP FOY30
351 FOY20 FDIV DX,DY,PINC ;(functions same as "FOFX")
352 FOY30 LDA #DY
353 LDY #DY/
354 JSR PPREP
355 FOY40 JSR PUTBIT ; * plot a single point *
356 JSR TSTCTR ; done ?
357 BNE FOY50
358 RTS
359 FOY50 JSR TSTPINC ;move x up or down by one ?
360 BCC FOY60 ;.(skip if not)
361 JSR GNX
362 FOY60 JSR GNY
363 JMP FOY40
364 ; Put (plot) a bit on screen
365 ; *** Entry for plotting ***
366 PUTBIT LDA SHOFLG ;don't plot if "hiding"
367 BNE PTB20
368 LDA TMP1YC+1 ; don't plot if off-screen
369 BNE PTB20
370 LDA TMP1YC
371 CMP #192
372 BCS PTB20
373 LDA TMP1XC
374 SBC #279
375 LDA TMP1XC+1
376 BMI PTB20
377 SBC #279/
378 BCS PTB20
379 LDY XOFSET
380 LDA PMSK
381 ; *** Entry for HPRINT ***
382 PUTCHR BIT INK
383 BVS PTB10
384 ORA (GBASL).Y ;ink = white
385 STA (GBASL).Y
386 RTS
387 PTB10 EOR #$7F ;ink = black

388 AND (GBASL).Y
389 STA (GBASL).Y
390 PTB20 RTS
391 ; Test for all-points-plotted.
392 TSTCTR INC PTCTR+1 ;:(reversed due to "fix" call)
393 BNE TCT10
394 INC PTCTR
395 TCT10 RTS
396 ; Get next Y-address
397 GNY LDA YDIR
398 BPL GNY10 ;branch if moving down.
399 SEC
400 LDA TMP1YC ;moving up: y := y-1
401 SBC #1
402 STA TMP1YC
403 LDA TMP1YC+1
404 SBC #0
405 STA TMP1YC+1
406 JMP GNY20
407 GNY10 INC TMP1YC ;moving down. y := y+1
408 BNE GNY20
409 INC TMP1YC+1
410 GNY20 JSR YADR ;Get new "y-address"
411 RTS
412 ; Get next x-address
413 GNX LDA XDIR
414 BPL GNX20
415 SEC
416 LDA TMP1XC ;moving left. x := x-1
417 SBC #1
418 STA TMP1XC
419 LDA TMP1XC+1
420 SBC #0
421 STA TMP1XC+1
422 SEC
423 LDA TMP1XC ;Are we beyond RHS of screen ?
424 SBC #279
425 LDA TMP1XC+1
426 SBC #279/
427 BCS GNX10 ;no...shift bit mask.
428 LSR PMSK
429 BCC GNX10
430 LDA #$40
431 STA PMSK
432 DEC XOFSET
433 BPL GNX10 ;gone beyond LHS of screen ?
434 LDA #0 ;yes! pin line at LHS.
435 STA XOFSET
436 LDA #1
437 STA PMSK
438 GNX10 RTS
439 ; moving to right
440 GNX20 INC TMP1XC
441 BNE GNX30
442 INC TMP1XC+1
443 GNX30 LDA TMP1XC+1
444 BMI GNX40 ;branch if to left of screen
445 ASL PMSK
446 BPL GNX40
447 LDA #1
448 STA PMSK
449 INC XOFSET
450 LDA XOFSET
451 CMP #40 ;are we beyond RHS of screen ?
452 BMI GNX40
453 LDA #39 ;yes! pin line at RHS
454 STA XOFSET
455 LDA #$40
456 STA PMSK
457 GNX40 RTS
458 PT375 DFC $80,$40,$00,$00,$00,$00,$00,$00
459 ; Prepare temp areas for plotting a line
460 PPREP JSR FLOAD ;Get dx or dy.
461 LDA #PT375
462 LDY #PT375/
463 JSR FADD
464 JSR FIX
465 LDA $A0
466 EOR #$FF
467 STA $A0
468 LDA $A1
469 EOR #$FF
470 STA $A1
471 LDX #3
472 PPR05 LDA IXC,X ;move starting x/y to zero-page
473 STA TMP1XC,X
474 DEX
475 BPL PPR05
476 ; Prepare TSTSUM & INCVAL These values tell us when to
477 ; change the value of the dependent coordinate
478 LDA PINC+1 ;In "TSTPINC", INCVAL
479 ORA #$80 ;is added to a sum. "TSTSUM"
480 STA INCVAL+1 ;When a carry is generated, we
481 STA TSTSUM+1 ;must increment the dependent
482 LDA PINC+2 ;coordinate value
483 STA INCVAL
484 STA TSTSUM
485 LDY PINC

```

continued on page 32

LISTING 2: TURTLE2 (continued)

```

486 CPY #S81
487 BNE PPR07
488 LDA #FFF
489 STA INCVAL
490 STA INCVAL+1
491 STA TSTSUM
492 STA TSTSUM+1
493 JMP PPR20
494 PPR07 CPY #S71
495 BCS PPR10
496 LDA #0
497 STA INCVAL
498 STA INCVAL+1
499 JMP PPR20
500 PPR10 CPY #S80
501 BCS PPR20
502 LSR INCVAL+1
503 ROR INCVAL
504 INY
505 JMP PPR10
506 PPR20 JSR YADR ;Get initial XY coordinates.
507 JSR XADR
508 LDY MSKIX
509 LDA BMSKS.Y
510 STA PMSK
511 RTS
512 BMSKS DFC $01,$02,$04,$08
513 DFC $10,$20,$40
514 ; Test to see if x or y coord should be altered.
515 TSTPINC CLC
516 LDA TSTSUM
517 ADC INCVAL
518 STA TSTSUM
519 LDA TSTSUM+1
520 ADC INCVAL+1
521 STA TSTSUM+1
522 RTS
523 ;
524 DFS .A$FFF8+8- ; align char. table
525 ULT
526 ;
527 ; Hires character table
528 CHRTAB DFC $00,$00,$00,$00,$00,$00,$00,$00 ; blank 20
529 DFC $08,$08,$08,$08,$08,$08,$08,$08 ; ! 21
530 DFC $14,$14,$14,$14,$14,$14,$14,$14 ; " 22
531 DFC $14,$14,$3E,$14,$3E,$14,$14,$00 ; # 23
532 DFC $08,$3C,$0A,$1C,$28,$1E,$08,$00 ; $ 24
533 DFC $06,$26,$10,$08,$04,$32,$30,$00 ; % 25
534 DFC $04,$0A,$0A,$04,$2A,$12,$2C,$00 ; & 26
535 DFC $08,$08,$08,$00,$00,$00,$00,$00 ; ' 27
536 DFC $08,$04,$02,$02,$02,$04,$08,$00 ; ( 28
537 DFC $08,$10,$20,$20,$20,$10,$08,$00 ; ) 29
538 DFC $08,$2A,$1C,$08,$1C,$2A,$08,$00 ; * 2A
539 DFC $00,$08,$08,$3E,$08,$08,$08,$00 ; + 2B
540 DFC $00,$00,$00,$00,$08,$08,$04,$00 ; , 2C
541 DFC $00,$00,$00,$3E,$00,$00,$00,$00 ; - 2D
542 DFC $00,$00,$00,$00,$00,$00,$08,$00 ; . 2E
543 DFC $00,$20,$10,$08,$04,$02,$00,$00 ; / 2F
544 DFC $1C,$22,$32,$2A,$26,$22,$1C,$00 ; 0 30
545 DFC $08,$0C,$08,$08,$08,$08,$1C,$00 ; 1 31
546 DFC $1C,$22,$20,$18,$04,$02,$3E,$00 ; 2 32
547 DFC $3E,$20,$10,$18,$20,$22,$1C,$00 ; 3 33
548 DFC $10,$18,$14,$12,$3E,$10,$10,$00 ; 4 34
549 DFC $3E,$02,$1E,$20,$20,$22,$1C,$00 ; 5 35
550 DFC $38,$04,$02,$1E,$22,$22,$1C,$00 ; 6 36
551 DFC $3E,$20,$10,$08,$04,$04,$04,$00 ; 7 37
552 DFC $1C,$22,$22,$1C,$22,$22,$1C,$00 ; 8 38
553 DFC $1C,$22,$22,$3C,$20,$10,$0E,$00 ; 9 39
554 DFC $00,$00,$08,$08,$08,$00,$00,$00 ; : 3A
555 DFC $00,$00,$08,$00,$08,$08,$04,$00 ; ; 3B
556 DFC $10,$08,$04,$02,$04,$08,$10,$00 ; < 3C
557 DFC $00,$00,$3E,$00,$3E,$00,$00,$00 ; = 3D
558 DFC $04,$08,$10,$20,$10,$08,$04,$00 ; > 3E
559 DFC $1C,$22,$10,$08,$08,$00,$08,$00 ; ? 3F
560 ;
561 DFC $1C,$22,$2A,$3A,$1A,$02,$3C,$00 ; @ 40
562 DFC $08,$14,$22,$22,$3E,$22,$22,$00 ; A 41
563 DFC $1E,$22,$22,$1E,$22,$22,$1E,$00 ; B 42
564 DFC $1C,$22,$02,$02,$02,$22,$1C,$00 ; C 43
565 DFC $1E,$22,$22,$22,$22,$22,$1E,$00 ; D 44
566 DFC $3E,$02,$02,$1E,$02,$02,$3E,$00 ; E 45
567 DFC $3E,$02,$02,$1E,$02,$02,$02,$00 ; F 46
568 DFC $3C,$02,$02,$02,$32,$22,$3C,$00 ; G 47
569 DFC $22,$22,$22,$3E,$22,$22,$22,$00 ; H 48
570 DFC $1C,$08,$08,$08,$08,$08,$1C,$00 ; I 49
571 DFC $20,$20,$20,$20,$20,$22,$1C,$00 ; J 4A
572 DFC $22,$12,$0A,$06,$0A,$12,$22,$00 ; K 4B
573 DFC $02,$02,$02,$02,$02,$02,$3E,$00 ; L 4C
574 DFC $22,$36,$2A,$2A,$22,$22,$22,$00 ; M 4D
575 DFC $22,$22,$26,$2A,$32,$22,$22,$00 ; N 4E
576 DFC $1C,$22,$22,$22,$22,$22,$1C,$00 ; O 4F
577 DFC $1E,$22,$22,$1E,$02,$02,$02,$00 ; P 50
578 DFC $1C,$22,$22,$22,$2A,$12,$2C,$00 ; Q 51
579 DFC $1E,$22,$22,$1E,$0A,$12,$22,$00 ; R 52
580 DFC $1C,$22,$02,$1C,$20,$22,$1C,$00 ; S 53
581 DFC $3E,$08,$08,$08,$08,$08,$08,$00 ; T 54
582 DFC $22,$22,$22,$22,$22,$22,$1C,$00 ; U 55
583 DFC $22,$22,$22,$22,$14,$14,$08,$00 ; V 56

```

```

584 DFC $22,$22,$22,$2A,$2A,$36,$22,$00 ; W 57
585 DFC $22,$22,$14,$08,$14,$22,$22,$00 ; X 58
586 DFC $22,$22,$14,$08,$08,$08,$08,$00 ; Y 59
587 DFC $3E,$20,$10,$08,$04,$02,$3E,$00 ; Z 5A
588 DFC $3C,$04,$04,$04,$04,$04,$3C,$00 ; [ 5B
589 DFC $00,$02,$04,$08,$10,$20,$00,$00 ; \ 5C
590 DFC $1E,$10,$10,$10,$10,$10,$1E,$00 ; ] 5D
591 DFC $08,$1C,$2A,$08,$08,$08,$00,$00 ; ^ 5E
592 DFC $00,$00,$00,$00,$00,$00,$3E,$00 ; _ 5F
593 ;
594 DFC $00,$00,$00,$00,$00,$00,$00,$00 ; blank 60
595 DFC $00,$00,$0E,$10,$1C,$12,$2C,$00 ; a 61
596 DFC $02,$02,$1A,$26,$22,$22,$1E,$00 ; b 62
597 DFC $00,$00,$1C,$22,$02,$02,$3C,$00 ; c 63
598 DFC $20,$20,$2C,$32,$22,$22,$3C,$00 ; d 64
599 DFC $00,$00,$1C,$22,$3E,$02,$3C,$00 ; e 65
600 DFC $18,$24,$04,$0E,$04,$04,$04,$00 ; f 66
601 DFC $00,$00,$3C,$22,$22,$3C,$20,$1E ; g 67
602 DFC $02,$02,$1A,$26,$22,$22,$22,$00 ; h 68
603 DFC $08,$00,$0C,$08,$08,$08,$1C,$00 ; i 69
604 DFC $10,$00,$10,$10,$10,$10,$12,$0C ; j 6A
605 DFC $02,$02,$22,$12,$0A,$16,$22,$00 ; k 6B
606 DFC $0C,$08,$08,$08,$08,$08,$1C,$00 ; l 6C
607 DFC $00,$00,$16,$2A,$2A,$2A,$2A,$00 ; m 6D
608 DFC $00,$00,$1A,$24,$24,$24,$24,$00 ; n 6E
609 DFC $00,$00,$1C,$22,$22,$22,$1C,$00 ; o 6F
610 DFC $00,$00,$1E,$22,$22,$1E,$02,$02 ; p 70
611 DFC $00,$00,$3C,$22,$22,$3C,$20,$20 ; q 71
612 DFC $00,$00,$1A,$26,$02,$02,$02,$00 ; r 72
613 DFC $00,$00,$3C,$02,$1C,$20,$1E,$00 ; s 73
614 DFC $00,$04,$0E,$04,$04,$04,$18,$00 ; t 74
615 DFC $00,$00,$12,$12,$12,$12,$2C,$00 ; u 75
616 DFC $00,$00,$22,$22,$22,$14,$08,$00 ; v 76
617 DFC $00,$00,$22,$22,$2A,$2A,$14,$00 ; w 77
618 DFC $00,$00,$22,$14,$08,$14,$22,$00 ; x 78
619 DFC $00,$00,$22,$22,$22,$3C,$20,$1E ; y 79
620 DFC $00,$00,$3E,$10,$08,$04,$3E,$00 ; z 7A
621 DFC $10,$08,$08,$04,$08,$08,$10,$00 ; curly [ 7B
622 DFC $00,$08,$08,$08,$08,$08,$08,$00 ; vertbar 7C
623 DFC $04,$08,$08,$10,$08,$08,$04,$00 ; curly ] 7D
624 DFC $00,$00,$04,$2A,$10,$00,$00,$00 ; tilde 7E
625 DFC $7F,$7F,$7F,$7F,$7F,$7F,$7F,$7F ; rubout 7F
626 ;

```

END OF LISTING 2

LISTING 3: TURTMAC — Source File for MicroSPARC Assembler

```

0 ;
1 ; *****
2 ; TURTMAC
3 ; TURTLE BASIC
4 ; BY J B WARD
5 ; COPYRIGHT (C) 1986
6 ; BY MICROSPARC, INC
7 ; CONCORD, MA 01742
8 ; *****
9 ;
10 ; Macro definitions--also uses MACLIB
11 ;
12 ; Evaluate a flt pt expression
13 FEVAL MAC
14 JSR $DD67
15 LDX # A
16 LDY # A
17 JSR $EB2B
18 EMC
19 ; Take abs value flt pt number
20 ABS MAC
21 LDA A+1
22 AND #$7F
23 STA A+1
24 EMC
25 ; Change sign of f p number
26 CHS MAC
27 LDA A+1
28 EOR #$80
29 STA A+1
30 EMC
31 ; Load Flt Pt Accum#1 with f p number
32 FLOAD MAC
33 LDA # A
34 LDY # A/
35 JSR $EAF9
36 EMC
37 ; Save Flt Pt Accum#1 to 5-byte field
38 FSAVE MAC
39 LDX # A
40 LDY # A/
41 JSR $EB2B
42 EMC
43 ; Convert floating point to integer
44 ; FIX fl,il ;il = fix(fl)
45 FIX MAC
46 FLOAD A
47 JSR $E10C

```



```

48 LDA $A1
49 STA :B
50 LDA $A0
51 STA :B+1
52 EMC
53 ; Add two f.p. numbers
54 FADD f1 : faccl := f1+faccl
55 FADD f1,f2 : f1 := f1+f2
56 FADD f1,f2,f3 : f3 := f1+f2
57 FADD MAC
58 AIF :B/
59 FLOAD :A
60 LDA #:B
61 LDY #:B/
62 JSR $E7BE
63 AIF :C/
64 FSAVE :C
65 ALS
66 FSAVE :A
67 AEN
68 ALS
69 LDA #:A
70 LDY #:A/
71 JSR $E7BE
72 AEN
73 EMC
74 ; Subtract two f.p. numbers
75 FSUB f1 : faccl := f1-faccl
76 FSUB f1,f2 : f1 := f1-f2
77 FSUB f1,f2,f3 : f3 := f1-f2
78 FSUB MAC
79 AIF :B/
80 FLOAD :B
81 LDA #:A
82 LDY #:A/
83 JSR $E7A7
84 AIF :C/
85 FSAVE :C
86 ALS
87 FSAVE :A
88 AEN
89 ALS
90 LDA #:A
91 LDY #:A/
92 JSR $E7A7
93 AEN
94 EMC
95 ; Multiply two f.p. numbers
96 FMPY f1 : faccl := f1*faccl
97 FMPY f1,f2 : f1 := f1*f2
98 FMPY f1,f2,f3 : f3 := f1*f2
99 FMPY MAC
100 AIF :B/
101 FLOAD :A
102 LDA #:B
103 LDY #:B/
104 JSR $E97F
105 AIF :C/
106 FSAVE :C
107 ALS
108 FSAVE :A
109 AEN
110 ALS
111 LDA #:A
112 LDY #:A/
113 JSR $E97F
114 AEN
115 EMC
116 ; Divide two f.p. numbers
117 FDIV f1 : faccl := f1/faccl
118 FDIV f1,f2 : f1 := f1/f2
119 FDIV f1,f2,f3 : f3 := f1/f2
120 FDIV MAC
121 AIF :B/
122 FLOAD :B
123 LDA #:A
124 LDY #:A/
125 JSR $EA66
126 AIF :C/
127 FSAVE :C
128 ALS
129 FSAVE :A
130 AEN
131 ALS
132 LDA #:A
133 LDY #:A/
134 JSR $EA66
135 AEN
136 EMC

```

END OF LISTING 3

LISTING 4: TURTLE

```

8800- 20 8B 88 20 A2 88 20 4B
8808- D6 20 2C 89 20 39 89 4C
8810- 03 E0 F2 8A DD 8A 60 8B

```

```

8818- 7C 8B C2 8B CB 8B 38 8C
8820- 5D 8C 4C 8B 94 8C E8 8B
8828- EF 8B D4 8B F6 8B 70 8C
8830- 73 8C 48 8D D7 8A D1 8A
8838- 46 57 C4 42 41 43 CB 4C
8840- 45 46 D4 52 49 47 48 D4
8848- 53 48 4F D7 48 49 44 C5
8850- 43 45 4E 54 45 D2 4E 45
8858- 53 D4 54 55 52 4E 54 CF
8860- 4A 55 4D D0 53 50 4C 49
8868- D4 46 55 4C CC 48 49 52
8870- 45 D3 56 49 45 57 A3 A1
8878- 44 CF 48 50 52 49 4E D4
8880- 42 4C 41 43 CB 57 48 49
8888- 54 C5 00 A0 00 84 50 A9
8890- D0 85 51 AD 81 C0 B1 50
8898- 91 50 C8 D0 F9 E6 51 D0
88A0- F5 60 A9 4C 8D 08 D6 8D
88A8- 37 D7 8D 46 D8 8D E5 D5
88B0- 8D D5 DE A9 A8 8D 0C D6
88B8- A9 89 8D 0D D6 A9 85 8D
88C0- 38 D7 A9 89 8D 39 D7 A9
88C8- C6 8D 47 8D A9 89 8D 48
88D0- D8 A9 E4 8D E6 D5 A9 89
88D8- 8D E7 D5 A9 F4 8D D6 DE
88E0- A9 89 8D D7 DE A2 06 BD
88E8- 25 89 9D 09 D1 CA 10 F7
88F0- A9 07 8D 20 D0 A9 8C 8D
88F8- 21 D0 A9 17 8D 22 D0 A9
8900- 8C 8D 23 D0 A9 DE 8D 12
8908- D0 A9 8B 8D 13 D0 A9 FF
8910- 8D 83 FD A0 05 B9 66 89
8918- 99 6C 89 88 10 F7 AD 80
8920- C0 AD 80 C0 60 50 4C 54
8928- A3 43 4C D2 A9 FF 85 73
8930- 85 6F A9 87 85 74 85 70
8938- 60 A9 FF 85 E4 A9 00 8D
8940- 77 8A A9 20 85 E6 20 39
8948- 8C 20 D2 8A A9 C8 8D 8B
8950- 8A A9 91 8D 8C 8A A9 7C
8958- 8D F2 03 A9 89 8D F3 03
8960- 49 A5 8D F4 03 60 7B 89
8968- 7B 89 E1 89 00 00 00 00
8970- 00 00 6C 6C 89 6C 6E 89
8978- 6C 70 89 60 AD 80 C0 AD
8980- 80 C0 4C 0D 9D C9 FF D0
8988- 05 20 72 89 90 17 C9 EB
8990- B0 06 E9 7E AA 4C 3A D7
8998- E9 EB AA 84 85 A9 38 85
89A0- 9D A9 87 85 9E 4C 44 D7
89A8- A5 0F C9 E9 90 0B 20 75
89B0- 89 90 0E BD 00 02 4C 0E
89B8- D6 A9 37 85 9D A9 88 85
89C0- 9E A0 00 4C A8 D5 C9 FF
89C8- D0 03 4C 78 89 38 E9 6C
89D0- C9 13 B0 0D 0A A8 B9 13
89D8- 88 48 B9 12 88 48 4C B1
89E0- 00 4C C9 DE F0 07 C9 48
89E8- F0 03 4C 6D D5 A9 00 85
89F0- 0E 4C E9 D5 A0 06 B1 B8
89F8- D9 59 8A D0 0A 88 10 F6
8A00- A2 7C A0 8A 4C 17 8A A0
8A08- 06 B1 B8 D9 60 8A D0 1B
8A10- 88 10 F6 A2 81 A0 8A 20
8A18- B1 00 90 FB 20 7D E0 B0
8A20- F6 A9 00 85 11 85 12 8A
8A28- 4C D8 DE A0 04 B1 B8 D9
8A30- 67 8A D0 1F 88 10 F6 A9
8A38- 71 A0 8A 20 F9 EA A9 86
8A40- A0 8A 20 66 EA A2 97 A0
8A48- 8A 20 2B EB A9 97 A0 8A
8A50- 4C 17 8A 20 E3 DF 4C D8
8A58- DE 54 55 52 54 4C 45 58
8A60- 54 55 52 54 4C 45 59 41
8A68- 4E 47 4C 45 83 49 0F DA
8A70- A1 7B 0E FA 35 12 00 00

```

continued on next page

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BLOAD*	9.5	2.6	0.5
WRITE**	44.6	14.9	7.7
READ**	42.2	12.4	5.5

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LISTING 4: TURTLE (continued)

8A78- 00 00 00 00 00 00 00 00
8A80- 00 00 00 00 00 00 00 00
8A88- 00 00 00 00 00 00 00 00
8A90- 00 00 00 00 00 00 00 00
8A98- 00 00 00 00 00 00 00 00
8AA0- 00 00 00 00 00 00 00 00
8AA8- 00 00 00 00 00 00 00 00
8AB0- 00 00 00 00 00 00 00 00
8AB8- 00 00 A0 00 B1 B8 60 48
8AC0- AD 19 C0 30 FB 68 60 20
8AC8- 67 DD 20 0C E1 A5 A1 A4
8AD0- A0 60 A9 00 8D 76 8A 60
8AD8- A9 FF 8D 76 8A 60 20 67
8AE0- DD A2 92 A0 8A 20 2B EB
8AE8- AD 93 8A 49 80 8D 93 8A
8AF0- 4C FD 8A 20 67 DD A2 92
8AF8- A0 8A 20 2B EB A9 86 A0
8B00- 8A 20 F9 EA 20 EA EF A9
8B08- 92 A0 8A 20 7F E9 A2 A6
8B10- A0 8A 20 2B EB A9 7C A0
8B18- 8A 20 BE E7 A2 97 A0 8A
8B20- 20 2B EB A9 86 A0 8A 20
8B28- F9 EA 20 F1 EF A9 92 A0
8B30- 8A 20 7F E9 A2 AB A0 8A
8B38- 20 2B EB A9 81 A0 8A 20
8B40- BE E7 A2 9C A0 8A 20 2B
8B48- EB 20 D6 8E 60 20 67 DD
8B50- A2 86 A0 8A 20 2B EB A9
8B58- 71 A0 8A 20 7F E9 4C 95
8B60- 8B 20 67 DD A2 97 A0 8A
8B68- 20 2B EB AD 98 8A 49 80
8B70- 8D 98 8A A9 97 A0 8A 20
8B78- F9 EA 4C 87 8B 20 67 DD
8B80- A2 97 A0 8A 20 2B EB A9
8B88- 71 A0 8A 20 7F E9 A9 86
8B90- A0 8A 20 BE E7 A2 97 A0
8B98- 8A 20 2B EB A9 6C A0 8A
8BA0- 20 F9 EA A9 97 A0 8A 20
8BA8- 66 EA 20 23 EC A9 6C A0
8BB0- 8A 20 7F E9 A9 97 A0 8A
8BB8- 20 A7 E7 A2 86 A0 8A 20
8BC0- 2B EB 60 AD 77 8A 29 7F
8BC8- 8D 77 8A 60 AD 77 8A 09
8BD0- 80 8D 77 8A 60 20 BF 8A
8BD8- AD 50 C0 AD 57 C0 60 20
8BE0- BF 8A AD 51 C0 AD 54 C0
8BE8- 60 20 BF 8A AD 53 C0 60
8BF0- 20 BF 8A AD 52 C0 60 20
8BF8- C7 8A 20 BF 8A 4A B0 04
8C00- AD 55 C0 60 AD 54 C0 60
8C08- 20 C7 8A 4A B0 05 A9 40
8C10- 85 E6 60 A9 20 85 E6 60
8C18- 18 A9 1F A4 65 E6 85 27
8C20- A9 00 A0 FF 85 26 2C 76
8C28- 8A 50 01 98 91 26 88 D0
8C30- FB 91 26 C6 27 CA 10 F4
8C38- 60 A2 09 BD 50 8C 9D 7C
8C40- 8A CA 10 F7 A2 03 BD 5A
8C48- 8C 9D 78 8A CA 10 F7 60
8C50- 88 0C 00 00 00 87 40 00
8C58- 00 00 8C 00 60 00 A2 09
8C60- A9 00 9D 7C 8A CA 10 FA
8C68- A2 03 9D 78 8A CA 10 FA
8C70- 60 4C DC D9 A9 03 20 D6
8C78- D3 A5 B9 48 A5 B8 48 A5
8C80- 76 48 A5 75 48 A9 B0 48
8C88- 20 C7 8A 85 50 84 51 20
8C90- 41 D9 4C D2 D7 A2 FF C9
8C98- C1 D0 01 E8 8E 92 8A D0
8CA0- 03 20 B1 00 C9 F2 D0 09
8CA8- 20 B1 00 20 1F 8D 4C D5
8CB0- 8C C9 F3 D0 09 20 B1 00
8CB8- 20 36 8D 4C D5 8C 20 67
8CC0- DD A2 97 A0 8A 20 2B EB
8CC8- 20 BE DE 20 67 DD A2 9C

8CD0- A0 8A 20 2B EB AD 77 8A
8CD8- 48 2C 92 8A 50 08 A9 00
8CE0- 8D 92 8A 20 CC 8B A9 7C
8CE8- A0 8A 20 F9 EA A9 97 A0
8CF0- 8A 20 A7 E7 A2 A6 A0 8A
8CF8- 20 2B EB A9 81 A0 8A 20
8D00- F9 EA A9 9C A0 8A 20 A7
8D08- E7 A2 AB A0 8A 20 2B EB
8D10- 20 D6 8E 68 8D 77 8A 20
8D18- B7 00 C9 C1 F0 83 60 A2
8D20- 09 BD 50 8C 9D 97 8A CA
8D28- 10 F7 A2 03 BD 5A 8C 9D
8D30- 78 8A CA 10 F7 60 A2 09
8D38- A9 00 9D 97 8A CA 10 FA
8D40- A2 03 9D 78 8A CA 10 FA
8D48- 60 20 BA 8A C9 28 D0 3B
8D50- 20 B1 00 20 67 DD A2 97
8D58- A0 8A 20 2B EB 20 BE DE
8D60- 20 67 DD A2 9C A0 8A 20
8D68- 2B EB 20 B8 DE 20 AE 8D
8D70- AD B8 8A 8D 8F 8A A2 FF
8D78- AD B6 8A E8 C9 07 90 05
8D80- E9 07 4C 7B 8D 8E 8D 8A
8D88- 8D 8E 8A A5 36 8D 80 8A
8D90- A5 37 8D 91 8A A9 F6 85
8D98- 36 A9 8D 85 37 20 B7 00
8DA0- 20 D5 DA AD 90 8A 85 36
8DA8- AD 91 8A 85 37 60 A9 97
8DB0- A0 8A 20 F9 EA 20 0C E1
8DB8- A5 A1 8D B6 8A A5 A0 8D
8DC0- B7 8A A9 9C A0 8A 20 F9
8DC8- EA 20 0C E1 A5 A1 8D B8
8DD0- 8A A5 A0 8D B9 8A AD B7
8DD8- 8A F0 0B C9 02 B0 14 AD
8DE0- B6 8A C9 18 B0 0D AD B9
8DE8- 8A D0 08 AD B8 8A C9 C0
8DF0- B0 01 60 4C 06 F2 85 D0
8DF8- 48 8A 48 98 48 A5 D0 29
8E00- 7F C9 20 B0 14 C9 D0 D0
8E08- 06 20 61 8E 4C 5B 8E C9
8E10- 07 D0 06 20 DD FB 4C 5B
8E18- 8E E9 20 85 D0 A9 00 06
8E20- D0 2A 06 D0 2A 06 D0 2A
8E28- 85 D1 A5 D0 6D 8B 8A 85
8E30- D0 A5 D1 6D 8C 8A 85 D1
8E38- AD 8D 8A 8D B2 8A A0 07
8E40- 8C B8 8A 20 76 8E 20 AD
8E48- 8E CE B8 8A 10 F5 EE 8D
8E50- 8A AD 8D 8A C9 28 90 03
8E58- 20 61 8E 68 A8 68 AA 68
8E60- 60 A9 00 8D 8D 8A 18 AD
8E68- 8F 8A 69 08 C9 B9 90 02
8E70- A9 00 8D 8F 8A 60 18 AD
8E78- 8F 8A 6D B8 8A A2 00 86
8E80- 27 AA 29 38 0A 0A 0A 26
8E88- 27 0A 26 27 05 26 8A 29
8E90- C0 4A 8D B3 8A 4A 4A 0D
8E98- B3 8A 05 26 6D B2 8A 85
8EA0- 26 8A 29 07 0A 0A 05 27
8EA8- 65 E6 85 27 60 AC B8 8A
8EB0- B1 D0 A0 00 AE 8E 8A F0
8EB8- 19 84 9D 0A 26 9D CA D0
8EC0- FA 0A 26 9D 4A 20 AE 90
8EC8- AE 8D 8A E0 27 B0 06 C8
8ED0- A5 9D 20 AE 90 60 A9 7C
8ED8- A0 8A 20 F9 EA 20 A0 E7
8EE0- 20 0C E1 38 A5 A1 ED 78
8EE8- 8A 10 05 49 FF 18 69 01
8EF0- C9 02 90 0A A5 A0 8D 79
8EF8- 8A A5 A1 8D 78 8A A9 81
8F00- A0 8A 20 F9 EA 20 A0 E7
8F08- 20 0C E1 38 A5 A1 ED 7A
8F10- 8A 10 05 49 FF 18 69 01
8F18- C9 02 90 0A A5 A0 8D 7B
8F20- 8A A5 A1 8D 7A 8A A9 97
8F28- A0 8A 20 F9 EA 20 0C E1

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8F38- B3 8A A9 9C A0 8A 20 F9
8F40- EA 20 0C E1 A5 A1 8D B4
8F48- 8A A5 A0 8D B5 8A A2 04
8F50- BD 97 8A 9D 7C 8A BD 9C
8F58- 8A 9D 81 8A CA 10 F1 20
8F60- 6D 8F A2 03 B5 A5 9D 78
8F68- 8A CA 10 F8 60 A9 00 8D
8F70- B2 8A AD A7 8A 8D B0 8A
8F78- AD AC 8A 8D B1 8A AD A7
8F80- 8A 29 7F 8D A7 8A AD AC
8F88- 8A 29 7F 8D AC 8A A2 00
8F90- BD AE 8A DD AB 8A D0 05
8F98- E8 E0 05 90 F3 B0 04 20
8FA0- 4C 90 60 20 09 90 60 A5
8FA8- A8 10 05 A9 00 4C 7D 8E
8FB0- F0 05 A9 BF 4C 7D 8E A5
8FB8- A7 C9 C0 90 02 A9 BF 4C
8FC0- 7D 8E A5 A5 85 A2 A5 A6
8FC8- 85 A3 10 09 A9 00 85 A2
8FD0- 85 A3 4C E8 8F 38 A5 A2
8FD8- E9 17 A5 A3 E9 01 90 08
8FE0- A9 17 85 A2 A9 01 85 A3
8FE8- 06 A2 26 A3 A0 07 A9 00
8FF0- 85 9E 88 30 11 26 9E 06
8FF8- A2 26 A3 38 A5 A3 E9 07
9000- 90 F0 85 A3 B0 EC 26 9E
9008- 60 AD A6 8A D0 0B A2 04
9010- 9D A1 8A CA 10 FA 4C 2E
9018- 90 A9 A6 A0 8A 20 F9 EA
9020- A9 AB A0 8A 20 66 EA A2
9028- A1 A0 8A 20 2B EB A9 A6
9030- A0 8A 20 3F 91 20 8F 90
9038- 20 BF 90 D0 01 60 20 B4
9040- 91 90 03 20 C6 90 20 E5
9048- 90 4C 35 90 AD AB 8A D0
9050- 0B A2 04 9D A1 8A CA 10
9058- FA 4C 71 90 A9 AB A0 8A
9060- 20 F9 EA A9 A6 A0 8A 20
9068- 66 EA A2 A1 A0 8A 20 2B
9070- EB A9 AB A0 8A 20 3F 91
9078- 20 8F 90 D0 BF 90 D0 01
9080- 60 20 B4 91 90 03 20 E5
9088- 90 20 C6 90 4C 78 90 AD
9090- 77 8A D0 2A A5 A8 D0 26
9098- A5 A7 C9 C0 B0 20 A5 A5
90A0- E9 17 A5 A6 30 18 E9 01
90A8- B0 14 A4 9E A5 9D 2C 76
90B0- 8A 70 05 11 26 91 26 60
90B8- 49 7F 31 26 91 26 60 E6
90C0- A1 D0 02 E6 A0 60 AD B1
90C8- 8A 10 10 38 A5 A7 E9 01
90D0- 85 A7 A5 A8 E9 00 85 A8
90D8- 4C E1 90 E6 A7 D0 02 E6
90E0- A8 20 A7 8F 60 AD B0 8A
90E8- 10 2D 38 A5 A5 E9 01 85
90F0- A5 A5 A6 E9 00 85 A6 38
90F8- A5 A5 E9 17 A5 A6 E9 01
9100- B0 14 46 9D 90 10 A9 40
9108- 85 9D C6 9E 10 08 A9 00
9110- 85 9E A9 01 85 9D 60 E6
9118- A5 D0 02 E6 A6 A5 A6 30
9120- 18 06 9D 10 14 A9 01 85
9128- 9D E6 9E A5 9E C9 28 30
9130- 08 A9 27 85 9E A9 40 85
9138- 9D 60 80 40 00 00 00 20
9140- F9 EA A9 3A A0 91 20 BE
9148- E7 20 0C E1 A5 A0 49 FF
9150- 85 A0 A5 A1 49 FF 85 A1
9158- A2 03 BD 78 8A 95 A5 CA
9160- 10 F8 AD A2 8A 09 80 85
9168- AA 85 AC AD A3 8A 85 A9
9170- 85 AB AC A1 8A C0 81 D0
9178- 0D A9 FF 85 A9 85 A5 85
9180- AB 85 AC 4C 9F 91 C0 71
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9188- B0 09 A9 00 85 A9 85 AA
9190- 4C 9F 91 C0 80 B0 08 46
9198- AA 66 A9 C8 4C 93 91 20
91A0- A7 8F 20 C2 8F A4 A3 B9
91A8- AD 91 85 9D 60 01 02 04
91B0- 08 10 20 40 18 A5 AB 65
91B8- A9 85 AB A5 AC 65 AA 85
91C0- AC 60 00 00 00 00 00 00
91C8- 00 00 00 00 00 00 00 00
91D0- 08 08 08 08 00 00 00 00
91D8- 14 14 14 00 00 00 00 00
91E0- 14 14 3E 14 3E 14 14 00
91E8- 08 3C 0A 1C 28 1E 08 00
91F0- 06 26 10 08 04 32 30 00
91F8- 04 0A 0A A5 AC 12 2C 00
9200- 08 08 08 00 00 00 00 00
9208- 08 04 02 02 02 04 08 00
9210- 08 10 20 20 20 10 08 00
9218- 08 2A 1C 08 01 2A 08 00
9220- 00 08 08 3E 08 08 00 00
9228- 00 00 00 00 08 08 04 00
9230- 00 00 00 3E 00 00 00 00
9238- 00 00 00 00 00 00 08 00
9240- 00 20 10 08 04 02 00 00
9248- 1C 22 32 2A 26 22 1C 00
9250- 08 0C 08 08 08 08 1C 00
9258- 1C 22 20 18 04 02 3E 00
9260- 3E 20 10 18 20 22 1C 00
9268- 10 18 14 12 3E 10 10 00
9270- 3E 02 1E 20 20 22 1C 00
9278- 38 04 02 1E 22 22 1C 00
9280- 3E 20 10 08 04 04 04 00
9288- 1C 22 22 1C 22 22 1C 00
9290- 1C 22 22 3C 20 10 0E 00
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92A0- 00 00 08 00 08 08 04 00
92A8- 10 08 04 02 04 08 10 00
92B0- 00 00 3E 00 3E 00 00 00
92B8- 04 08 10 20 10 08 04 00
92C0- 1C 22 10 08 08 00 08 00
92C8- 1C 22 2A 3A 1A 02 3C 00
92D0- 08 14 22 22 3E 22 22 00
92D8- 1E 22 22 1E 22 22 1E 00
92E0- 1C 22 02 02 02 22 1C 00
92E8- 1E 22 22 22 22 22 1E 00
92F0- 3E 02 02 1E 02 02 3E 00
92F8- 3E 02 02 1E 02 02 02 00
9300- 3C 02 02 02 32 22 3C 00
9308- 22 22 22 3E 22 22 22 00
9310- 1C 08 08 08 08 08 1C 00
9318- 20 20 20 20 20 22 1C 00
9320- 22 12 0A 06 0A 12 22 00
9328- 02 02 02 02 02 02 3E 00
9330- 22 36 2A 2A 22 22 22 00
9338- 22 22 26 2A 32 22 22 00
9340- 1C 22 22 22 22 22 1C 00
9348- 1E 22 22 1E 02 02 02 00
9350- 1C 22 22 22 2A 12 2C 00
9358- 1E 22 22 1E 0A 12 2C 00
9360- 1C 22 02 1C 20 22 1C 00
9368- 3E 08 08 08 08 08 00 00
9370- 22 22 22 22 22 22 1C 00
9378- 22 22 22 22 14 14 08 00
9380- 22 22 22 2A 2A 36 22 00
9388- 22 22 14 08 14 22 22 00
9390- 22 22 14 08 08 08 08 00
9398- 3E 20 10 08 04 02 3E 00
93A0- 3C 04 04 04 04 04 3C 00
93A8- 00 02 04 08 10 20 00 00
93B0- 1E 10 10 10 10 10 1E 00
93B8- 08 1C 2A 08 08 08 00 00
93C0- 00 00 00 00 00 00 3E 00
93C8- 00 00 00 00 00 00 00 00
93D0- 00 00 0E 10 1C 12 2C 00
93D8- 02 02 1A 26 22 22 1E 00
93E0- 00 00 1C 22 02 02 3C 00
```


What every Apple II+ and IIe user should ask before buying the "Sider" 10 MB hard disk:

When a company offers a superior quality 10 megabyte Winchester hard disk for only \$695, it's bound to raise a few eyebrows...and a lot of questions. The fact is, you're probably already wondering "Can I really get a 10 megabyte hard disk that's *reliable* for only \$695?" The answer is: ABSOLUTELY...when you choose the Sider from First Class Peripherals.

What's so great about the Sider?

For starters, the Sider lets you boot your **Apple II+** or **IIe** directly off the hard disk—unlike some other Winchester subsystems. Rebooting is also trouble-free. And the disk is partitionable, allowing you to allocate space to four operating systems on the same disk. The Sider supports: Apple DOS 3.3; Pro DOS™; Apple Pascal; and CP/M®.

What's more, a small "footprint" lets you incorporate the compact Sider into your existing computer set-up with ease.

In addition, with the Sider, you not only pay far less for the subsystem, you also save money on installation. Because, unlike other 10 MB systems that require the purchase of expensive "extras," the Sider is *plug and play*. Everything you need is provided, including cables, host adaptor, installation software and manual.

What makes it so reliable?

To start, the Sider is manufactured, and sold exclusively, by First Class Peripherals, an innovative computer company which is backed by Xebec. The computer industry's leading manufacturer of disk controllers, Xebec has over a decade of experience serving customers like IBM, Toshiba, Texas Instruments and Hewlett Packard. It's this kind of expertise that helps assure the Sider's performance.

Special design features further enhance reliability. The Sider's controller is the field-proven, industry standard Xebec SI410A. And Xebec's 3200 drive tester, the



“Only \$595”

OCTOBER 1 thru DECEMBER 31, 1985

toughest in the industry, ensures that the Sider will operate reliably. One more assurance of the \$695 Sider's quality: it's UL Approved and FCC Class B rated.

But why is it only \$695?

You pay less for the Sider than for other 10 MB hard disks simply because you're paying for the superior quality components inside the unit, not for a lot of retail overhead costs. Since First Class Peripherals sells direct, you avoid dealer and dis-

tribution expenses, and pay only for the product.

What about a guarantee?

Like many experienced Apple users, you may be reluctant to buy a hard disk priced at only \$695 without first seeing for yourself how it performs. That's why First Class Peripherals offers you a reassuring, money-back guarantee that eliminates any risk on your part. Simply order the Sider and use it for 15 days. Then, if you're not entirely satisfied, return it and receive a full refund—no questions asked.

The Sider also comes with a full one-year limited warranty. Plus, there's a convenient, toll-free hotline you can call anytime you have a technical or service question, or need help.

Don't delay.

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To receive the Sider 10 megabyte Winchester hard disk subsystem for only \$695, simply order using the coupon below. For faster service, order by phone and charge to your VISA, MasterCard or American Express. (You can also call us if you have any questions or technical concerns about the Sider. We'll see you get the help you need.) Call toll-free:

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CANADA: 1-800-227-7792, Ext. 204

☐ Yes, please send me the Sider, including half-height 10 megabyte Winchester hard disk drive, Apple adaptor board, cable, complete installation software and documentation.

I prefer to pay as follows:

☐ I've enclosed my check or money order for \$695* + \$15 shipping and handling, payable to First Class Peripherals.

☐ Please bill the following credit card account for \$695* + \$15 shipping and handling:

☐ VISA ☐ MasterCard ☐ American Express

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Signature _____
*Residents of CA, NV and PA, please add appropriate sales tax.

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Address _____

City _____

State _____ Zip _____

Telephone (area code) _____

Mail to:

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3579 Highway 50 East
Carson City, NV 89701

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LISTING 4: TURTLE (continued)

```

93E8- 20 20 2C 32 22 22 3C 00
93F0- 00 00 1C 22 3E 02 3C 00
93F8- 18 24 04 0E 04 04 04 00
9400- 00 00 00 3C 22 22 3C 20 1E
9408- 02 02 1A 26 22 22 22 00
9410- 08 00 0C 08 08 08 1C 00
9418- 10 00 10 10 10 10 12 0C
9420- 02 02 22 12 0A 16 22 00
9428- 0C 08 08 08 08 08 1C 00
9430- 00 00 16 2A 2A 2A 2A 00
9438- 00 00 1A 24 24 24 24 00
9440- 00 00 1C 22 22 22 1C 00
9448- 00 00 1E 22 22 1E 02 02
9450- 00 00 3C 22 22 3C 20 20
9458- 00 00 1A 26 02 02 02 00
9460- 00 00 3C 22 02 1C 20 1E 00
9468- 00 04 0E 04 04 04 18 00
9470- 00 00 12 12 12 12 2C 00
9478- 00 00 22 22 22 14 08 00
9480- 00 00 22 22 2A 2A 14 00
9488- 00 00 22 14 08 14 22 00
9490- 00 00 22 22 22 3C 20 1E
9498- 00 00 3E 10 08 04 3E 00
94A0- 10 08 08 04 08 08 10 00

```

```

94A8- 00 08 08 08 08 08 00
94B0- 04 08 08 10 08 08 04 00
94B8- 00 00 04 2A 10 00 00 00
94C0- 7F 7F 7F 7F 7F 7F 7F

```

END OF LISTING 4

KEY PERFECT 5.0 RUN ON TURTLE

CODE-5.0	ADDR# - ADDR#	CODE-4.0
A111E0E5	8800 - 884F	299A
E8A49E43	8850 - 889F	2B01
F1783BB6	88A0 - 88EF	23DC
32EEDF73	88F0 - 893F	280C
7CF6D448	8940 - 898F	2799
3E19F92E	8990 - 89DF	2643
27B1C53E	89E0 - 8A2F	2D34
8001C39C	8A30 - 8A7F	2B2F
47BC6D84	8A80 - 8ACF	0AC4
314905CE	8AD0 - 8B1F	248F
CE5C46D1	8B20 - 8B6F	288F
0517E253	8B70 - 8BBF	2226
E7989E91	8BC0 - 8C0F	254F
E970252A	8C10 - 8C5F	28B1

```

E7F9EE6B 8C60 - 8CAF 276C
78411D8B 8CB0 - 8CFF 2455
761D263E 8D00 - 8D4F 286A
8637968B 8D50 - 8D9F 26B1
44E012F2 8DA0 - 8DEF 2929
4BC231D0 8DF0 - 8E3F 2640
21C7CCD4 8E40 - 8E8F 218D
B264882E 8E90 - 8EDF 29D1
A698E43E 8EE0 - 8F2F 2E6B
339B1124 8F30 - 8F7F 280D
CB032027 8F80 - 8FCF 2273
406D791C 8FD0 - 901F 2767
86DF9D24 9020 - 906F 27A0
4F1003F5 9070 - 90BF 2E05
B6836058 90C0 - 910F 2935
17DCA5F4 9110 - 915F 23CD
D192B28D 9160 - 91AF 2894
8C12AFAD 9180 - 91FF 2741
FFA12704 9200 - 924F 2A2C
6F6A3532 9250 - 929F 24BF
4CFCD37F 92A0 - 92EF 2884
789D0584 92F0 - 933F 2981
37B63830 9340 - 938F 2A54
8C74F253 9390 - 93DF 26DE
23C119C7 93E0 - 942F 29E4
512869CB 9430 - 947F 23B0
40F1C498 9480 - 94C7 2318
325BB538 = PROGRAM TOTAL = 0CC8

```

LISTING 5: DEMO1

```

1 REM *****
2 REM * DEMO1 *
3 REM * BY J.B. WARD *
4 REM * COPYRIGHT (C) 1986 *
5 REM * BY MICROSPARC, INC *
6 REM * CONCORD, MA 01742 *
7 REM *****
8 REM
9 REM INSTALL TURTLE BEFORE LOADING
10 !
20 ! DEMO1.. Draw a "squirrel"
30 !
40 DA = 15
50 SQUARE = 240: ! Sub.line #
60 !
70 VIEW# 1: PLT# 1
80 CLR : FULL : HIRES
90 CENTER : TURNT0 30
100 HPRINT (100,0)"* Squirrel *"
110 FOR N = 1 TO 63
120 DO SQUARE
130 A = A + 1: LEFT DA
140 NEXT N
150 PRINT CHR$ (7)
160 HPRINT (90,180)"Press Return"
170 GET X$
180 TEXT
190 END
200 !
210 !
220 ! Subroutine "SQUARE"
230 !
240 FOR J = 1 TO 4: FWD 10 + A: LEFT
90: NEXT J
250 RETURN

```

END OF LISTING 5

```

100 TRIANGL = 150
110 GOTO 650
120 !
130 ! SUBROUTINE:TRIANGL
140 !
150 HIDE : FWD L2: SHOW
160 LEFT A1
170 FWD L1: LEFT A2
180 FWD L1: LEFT A2
190 FWD L1
200 RETURN
210 !
220 ! SUB. TO DRAW FACE, ETC.
230 !
240 HPRINT (120,80)"O O"
250 HPRINT (120,89)"/ " : CHR$ (
92)
260 CENTER
270 JUMP 123,94
280 TURNT0 45: FWD 3
290 LEFT 20: FWD 3: LEFT 20: FWD 3
300 LEFT 5: FWD 6
310 LEFT 25: FWD 3
320 LEFT 20: FWD 2
330 ! FACE DONE; DO REST.
340 JUMP 0,150
350 TURNT0 0: FWD 270
360 JUMP 40,160: TURNT0 - 110
370 FWD 30: HIDE : FWD 25: SHOW
: FWD 5
380 JUMP 5,135: TURNT0 - 90
390 FOR I = 1 TO 12
400 FWD 6: RIGHT 12.5
410 NEXT I
420 JUMP 5,135
430 FOR I = 1 TO 3
440 TURNT0 - 80
450 FOR J = 1 TO 4
460 FWD 6: RIGHT 40
470 NEXT J: NEXT I
480 !
490 HPRINT (100,125)"SUMMERTIME!"
500 HPRINT (188,1)"PRESS <SPACE>"
510 HPRINT (205,9)"TO STOP "
520 RETURN
530 !
540 ! SUBROUTINE TO STOP ON
550 ! ANY KEYSTROKE
560 !
570 K2 = PEEK (49152)
580 IF K1 = K2 THEN RETURN
590 PLT# 1: VIEW# 1
600 HOME : TEXT

```

LISTING 6: DEMO2

```

1 REM *****
2 REM * DEMO2 *
3 REM * BY J.B. WARD *
4 REM * COPYRIGHT (C) 1986 *
5 REM * BY MICROSPARC, INC *
6 REM * CONCORD, MA 01742 *
7 REM *****
8 REM
9 REM INSTALL TURTLE BEFORE LOA
DING

```



```

610 END
620 !
630 ! MAIN PROGRAM
640 !
650 L1 = 28.8
660 L2 = 100
670 A1 = 150
680 A2 = 120
690 FULL : WHITE
700 PLT# 0: CLR : PLT# 1: CLR
710 HIRES
720 P = 0:V = 1
730 S = 5
740 !
750 FOR A = 0 TO 360 STEP S
760 CENTER : TURNT0 A
770 P = NOT P:V = NOT V
780 PLT# P: VIEW# V
790 DO TRIANGL
800 NEXT A
810 !
820 GOSUB 240
830 PLT# V
840 GOSUB 240
850 !
860 D = 50
870 K1 = PEEK (49152)
880 GOSUB 570
890 FOR I = 1 TO D: NEXT I
900 V = NOT V: VIEW# V
910 GOTO 880

```

END OF LISTING 6

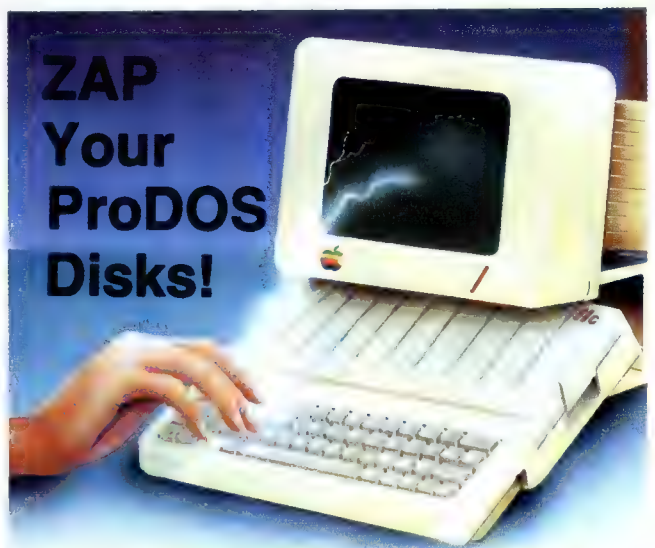
LISTING 7: DEMO3

```

1 REM *****
2 REM * DEMO3 *
3 REM * BY J.B. WARD *
4 REM * COPYRIGHT (C) 1986 *
5 REM * BY MICROSPARC, INC *
6 REM * CONCORD, MA 01742 *
7 REM *****
10 REM DEMONSTRATION OF TURTLE
    BASIC
20 REM
30 REM INSTALL TURTLE BEFORE LO
    ADING
40 !
50 ! (1): Draw the big one.
60 VIEW# 1: PLT# 1
70 WHITE : CLR
80 FULL : HIRES
90 L = 180
100 FOR A = 0 TO 359
110 CENTER : TURNT0 A
120 FWD L
130 NEXT A
140 !
150 ! (2): Draw the little one.
160 BLACK
170 S = 3:L = 45
180 FOR A = 0 TO 359 STEP S
190 CENTER : TURNT0 A
200 FWD L
210 NEXT A
220 WHITE
230 !
240 !
250 ! (3): Message & wait.
260 !
270 CENTER : FWD 0
280 BLACK
290 HPRINT (90,183);
300 FOR N = 1 TO 14
310 HPRINT CHR$ (127);
320 NEXT N
330 WHITE
340 HPRINT (98,184)"Press Return"
350 PRINT CHR$ (7)
360 INPUT X$
370 TEXT
380 END

```

END OF LISTING 7



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with Nibble's ProZAP!

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ProZAP includes these advanced features!

- View a full block of disk data (512 bytes) displayed on the 80-column screen in both ASCII and hexadecimal formats.
- Edit disk blocks with simple cursor movement using the arrow keys to position your entries for retyping.
- Instantly display free and used disk blocks.
- Print the full screen to your 80-column printer.
- Get HELP — full instructions are displayed with a single keystroke.

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(Add \$1.50 for U.S. shipment, \$2.50 outside the U.S., Mass residents add 5% sales tax) Payable in U.S. funds only.

Name _____ Tel. # _____

Address _____

City _____ State _____ Zip _____

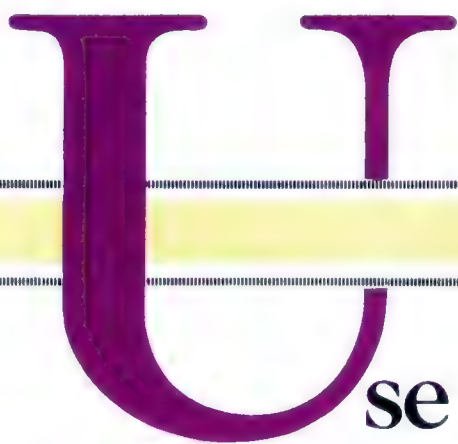
Signature _____ Date _____

Charge Card # _____ Exp. Date _____

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C NIBBLE CALCULATOR

by Newton Saiyuen Lee



SECOND FEATURE

Use your Apple
as a full-function scientific calculator. Features include
hyperbolic trig functions, six memory registers, and five user-
defined programs.

The Nibble Calculator is a super calculator for the Apple II series. It's powerful, flexible and simple to use. Nibble Calculator can hold up to five user programs in memory at the same time. Your program can use the value in the calculator display and pass a value back. Like a hand-held programmable calculator, it carries out a full range of mathematical functions activated by one or two keypresses (see Figure 1).

USING NIBBLE CALCULATOR

Built-in Functions and Keys

The built-in function keys are defined in Table 1. The function keys calculate trigonometric functions, exponents, logarithms, roots, powers, absolute values, reciprocals, hyperbolic functions and factorials. Other built-in functions and keys are defined below.

<ESC> — Quit Key. When you press <ESC>, you are first asked for confirmation. Then the user-defined programs and the values stored in memory slots 1-6 are saved to disk. If the program is terminated in a different way, the memories and the user-defined programs are not saved.

V — Second Function Selection Key. When this key is pressed,

the arrow next to the V, which normally points to the left, points to the right and flashes, indicating that the second functions (those enclosed in square brackets in Figure 1) can be selected. For example, 0.5 V S means ARCSIN(0.5). The V key is a toggle key; that is, if V is pressed by mistake, the first function can be restored by pressing V again. For example, 45 V V S means SIN(45).

@ — Degree/Radian Selection Key. The at sign (@) is used to change the mode of operation for trigonometric and inverse trigonometric functions. In DEG mode (the default), entries and answers are all in decimal degrees. In RAD mode, they are all in radians (1 radian = $180/\pi$ degrees).

D — Display Clear Key. D is used to clear the display (i.e., set it to zero).

P — User-Defined Program Execution Key. Press P to run the user-defined programs. Select the program by number. See the Creating Your Own Programs section for more details.

— User-Defined Program Programming Key. The pound sign (#) enters the section of Nibble Calculator that allows you to create or modify user-defined programs. See the Creating Your Own Programs section for more details.

K S — Memory Store. K followed by S is used to store the displayed number in the specified memory slot. The old value in the

Newton Saiyuen Lee, Management Information Center, Vincennes University, Vincennes, IN 47591. Nibble Calculator is compatible with DOS 3.3 and ProDOS.

FIGURE 1: Main Calculator Display



slot (if there is one) is erased before the new value is stored in it. For example, 3.5 K S 1 instructs Nibble Calculator to store 3.5 in memory slot 1.

To clear memory slot n , simply type K S n when the displayed number is zero. The display can be set to zero by pressing D. For example, D K S 5 clears memory slot 5.

If the K S key combination is used during a calculation, the result of the calculation is stored in the specified memory slot. For example:

55 + 10 K S 1

puts the result of the calculation (65) into memory slot 1. This is equivalent to typing:

55 + 10 <RETURN> K S 1

When you press the K key, the K just below the display begins to flash. When you press S, the K stops flashing and the S begins flashing. When you press the slot number (1-6) the S stops flashing and the store operation is completed. If you press a key that is not expected, the bell sounds to indicate the error, the flashing stops and the calculator returns to normal entry mode.

K R — Memory Recall. This key sequence is used to retrieve the value stored in the specified memory slot. The value in the slot is not erased. For example, K R 2 retrieves the value from memory slot 2. If the K R key combination is used during a calculation, the number stored in the specified memory slot will be recalled and evaluated with the number in the display. For example: 12 + K R 1 adds the number stored in memory slot 1 to the number 12 (in the display window).

In a manner similar to that described above for the memory store operation, the K and R will flash until the next key in the sequence is pressed.

Numeric Keys. Numeral keys (0-9) are used to enter numbers. The decimal key (.) is used when entering a decimal number. The exponent key (E) is used to enter exponents. For example, 12.5 E 5 signifies 12.5×10^5 . The unary minus key (U) is used when enter-

ing negative numbers or negative exponents. For example:

U 12.5 = -12.5

1.0 E U 5 = 1.0 E -5

Arithmetic Calculation Keys. Use a plus sign (+) for addition, a minus sign (-) for subtraction, an asterisk (*) for multiplication, and a slash (/) for division. The priority level is the same for all operators and functions, and they are performed from left to right. For example:

5 + 6 * 5 = 11 * 5 = 55

To get the result of a calculation, you can use either <RETURN> or equals (=).

Since Nibble Calculator doesn't support parentheses, it may be necessary to work from inside an expression out, or to use the memory feature to store an intermediate result. For instance, to get the expected result for the expression above, use the sequence:

6 * 5 + 5 = 35

Entering Your Own Programs in Nibble Calculator

From the main menu (Figure 1) press the pound sign (#) to display the programming menu. This is a list of the five available programs. The solid box marks a user program that has already been defined. Let's create a short program and enter it. Press 1, and you should see TAG = at the top of the screen. Fill in the name for the new program by typing:

ONE-VARIABLE STATISTICAL CALC

and press the <RETURN> key. (The first 70 characters you type are saved.) The following message will be displayed:

ENTER YOUR PROGRAM #1 [3310-3510]
[BLANK LINE = FINISH; Q = QUIT]

You can now enter your new program, just as you would enter an Applesoft program. The line number range for program 1 is 3310 to 3510, as shown inside the brackets. If you try to type in a line number outside this range, you will get the error message:

LINE NUM OUT OF RANGE [3310-3510] RETYPE LINE

The value shown in the calculator display is available for use by your user program in the variable N. It is automatically passed to this variable when you select a user program. Similarly, if you wish to return a value from your user program to the main calculator, simply assign it to the variable N before returning from your program.

The program can be written like a BASIC program, with the following restrictions:

1. The line number range is limited as specified.
2. The maximum number of lines per program is 100.
3. No comma (,) or colon (:) is allowed.
4. No STOP, END or NEW statement is allowed.
5. You must be very careful with GOTO, THEN, and GOSUB statements, as their misuse can lead to unexpected results and errors.

If you enter a blank line when typing in a new program, you automatically leave the input mode and return to the main calculator program. However, Nibble Calculator keeps your program in memory. Pressing Q lets you quit the user-defined program section and the program you just entered is erased from memory.

Type in the listing in **Example 1** and when you have finished, press the <RETURN> key twice. The disk drive will spin for a while as it creates an EXEC file for your program and you will return to the main calculator display.

Editing Programs

Press the pound sign again to go back to the programming menu. If you press 1, since program 1 already exists, Nibble Calculator puts you automatically into edit mode, and the following message is displayed:

EDIT > L(IST T(TAG C(HANGE E(RASE Q(UIT

The edit functions are as follows:

1. L (list) displays a listing of the program (use <CTRL> S to pause)
2. T (tag) changes the TAG of the program
3. C (change) makes modifications to the program
4. E (erase) deletes the program
5. Q quits updating the program (and causes the current program to be discarded)

The functions are self-explanatory except for the change function. When you press C, you will see:

EXAMPLE 1: Sample User-Defined Program

```
3310 DIM X(50)
3315 INPUT "NUMBER OF SAMPLES (2-50)? ";N1
3320 PRINT "ENTER NUMERIC VALUE"
3325 FOR I = 1 TO N1
3330 PRINT I;
3335 INPUT "? ";X(I)
3340 NEXT
3345 FOR I = 1 TO N1
3350 S1 = S1 + X(I)
3355 S2 = S2 + X(I) * X(I)
3360 NEXT
3365 PRINT "TOTAL OF SAMPLES = ";S1
3370 PRINT "SUM OF SQUARES OF SAMPLE = ";S2
3375 S = S1 / N1
3380 PRINT "MEAN VALUE OF SAMPLES = ";S
3385 ST = SQR ((S2 - N1 * S * S) / (N1 - 1))
3390 PRINT "STANDARD DEVIATION = ";ST
3400 N = ST
```

TABLE 1: Function Keys

Keys	Abbreviation	Function
S	SIN	Sine
C	COS	Cosine
T	TAN	Tangent
VS	ARCSIN	Arcsine
VC	ARCCOS	Arccosine
VT	ARCTAN	Arctangent
X	EXP	Natural exponential (antilogarithm base e)
VL	LOG10	Antilogarithm base 10
Q	SQRT	Square root
VQ	X^2	Square
A	ABS	Absolute value
VA	X^Y	X to the Y power
M	MOD	A MOD B
VM	X^1/Y	Yth root of X
I	INT	Integer truncation e.g., 4.88 I = 4
VI	1/X	Reciprocal
R	RND	Random number between zero and one
VR	X!	Factorial
N	SINH	Hyperbolic sine
O	COSH	Hyperbolic cosine
H	TANH	Hyperbolic tangent
VN	ARCSINH	Inverse hyperbolic sine
VO	ARCCOSH	Inverse hyperbolic cosine
VH	ARCTANH	Inverse hyperbolic tangent

CHANGE > ENTER LINE(S): [3310-3510]
[BLANK LINE = FINISH; Q = QUIT]

You change a line in very much the same way that you enter a new one. Type the line number of the line you want to change and then the line with the changes you want. If you want to add a new line to your program, type the line number and the new line. Enter a blank line when you are through making changes.

Running Programs

Press the P key to display the run menu, which is nearly identical to the programming menu. The solid block marks programs that have been entered. If you try to run a program that has not yet been entered, the error message PROGRAM #n IS EMPTY is displayed. To run a program, simply type the program number. Press 1 to run ONE-VARIABLE STATISTICAL CALC. If there are any errors or typing mistakes, an appropriate message is displayed, and you are returned to the main calculator display. Choose the pound sign option and edit the program using the C option.

Error Messages

When you are using the normal functions on Nibble Calculator, three kinds of errors may occur:

1. **DIVISION BY ZERO** — This error occurs when you try to divide a number by zero. For example: 5/0 <RETURN>
2. **ILLEGAL QUANTITY** — This error occurs when you try to:
(a) Apply LOG to a negative number or zero; (b) Apply SQR to a negative number; (c) Use X^Y when X is negative and Y is not an integer; or (d) Apply ARCTANH (inverse hyperbolic tangent) to a number whose absolute value is greater than 1.
3. **OVERFLOW** — This error occurs when the result of a calculation is too big. You will receive this error message if you enter, for example, 10 E 50 * 20 E 50.

To clear the error message from the display, simply press <RETURN>.

TABLE 2: Program Functions

Lines	Function
90	Dimensions A\$, LA%, UA%, P%, T\$ and M
100	Defines the line number range for user-defined programs
110-130	Initializes NIBBLE.CALC
140-160	Set MODE = DEG, PI = 3.141592654, and display value = 0
170-450	Handle first functions requested by user
460-470	SIN function
480-490	COS function
500-510	TAN function
520	INT function
530	RND function
540	ABS function
550	SQR function
560	EXP function
570	LOG function
580-620	MOD function
630-650	SINH function
660-680	COSH function
690-710	TANH function
720-850	Handle second function requested by user
860-890	ARCSIN function
900-930	ARCCOS function
940-950	ARCTAN function
960	1/X
970-980	X!
990-1030	X^Y
1040	X^2
1050	LOG10
1060	10^X
1070-1110	X^(1/Y)
1120-1140	ARCSINH function
1150-1170	ARCCOSH function
1180-1200	ARCTANH function
1210-1230	Clear display function (D)
1240-1280	Memory-in/memory-out functions (K STO/RCL)
1290-1360	Arithmetic functions
1370	Error trap for saving memory
1380-1440	Display DV\$ and set new number
1450-1480	Display DV\$
1490-1510	Erase left arrow and display right arrow
1520-1570	Erase right arrow and display left arrow; display angular mode selection
1580-1690	Handle K STO/RCL request as the second function
1700-1890	Accept user input number and put it into TV\$
1900-2100	Run user-defined programs
2110-2280	Create and modify user-defined programs
2290-2420	Create new program
2430-2990	Modify old program:
2510-2550	List
2570-2750	Change
2770-2900	Erase
2920	Quit
2940-2990	Tag
3000-3180	Set up EXEC file for the user-defined program
3190-3230	Schedule an EXEC
3270-4480	User-defined program buffer areas
4520-4810	Error handling routine
4820-4950	Read CAL.INFO
4960-5060	Read CAL.MEMORY
5070-5170	Save MEMORY values and user-defined programs
5180-5570	Main calculator display
5580-5620	Store and recall the value of N for use by user-defined programs

Errors may also occur when running the user-defined programs. The line number where the error is found is displayed, along with the error message. To clear the error message and return to the main menu, simply press <RETURN>. (For a detailed description of the error messages, read the *Apple II Reference Manual*.)

ENTERING THE PROGRAM

To key in Nibble Calculator, type Listing 1 and save it with the command:

SAVE NIBBLE.CALC

Because of the user-defined program feature, the lines between lines 3300 and 4480 are not consecutively numbered by tens. For help in entering *Nibble* listings, see "A Welcome to New *Nibble* Readers" at the beginning of this issue.

HOW IT WORKS

Table 2 documents each section of the program. Some unusual features are explained below in more detail.

Permanent External Files

Two external files must be present for Nibble Calculator to work properly:

1. CAL.INFO contains the values of P%(n) and T\$(n), where $1 < n \leq 5$. If this file is not present when NIBBLE.CALC is run, it is automatically created, using zeros and null strings to fill the two arrays.
2. CAL.MEMORY contains the values of M(N) where $1 \leq N \leq 6$ (see Table 3). If this file is not present when NIBBLE.CALC is run, it is automatically created, using zeros to fill the array.

User-Defined Program EXEC Files

A maximum of six EXEC files can be created by NIBBLE.CALC.

TABLE 3: Variable Usage

Variable	Function
AS(m)	Program line for the user-defined program (maximum number of lines per program = m)
CS	Command character typed by the user
DV	Decimal equivalent of DV\$
DV\$	Displayed value in the display window
E%	Error flag (1 if an arithmetic error occurs; 0 otherwise)
ES	Contains DOS error messages
EC%	E counter (1 if you type in E as part of the number; 0 otherwise)
K%	KSTO/KRCL flag (0 if KRCL is requested; 1 if KSTO is requested)
LA%(n)	Lowest line number for the user-defined program n
M(l)	The number stored in memory slot l
M%	Angular mode indicator (0 if MODE = DEG; 1 if MODE = RAD)
N	The value that can be passed to user programs and returned from user programs
N\$	The memory slot number typed in by the user
P%(n)	User-defined program existence indicator (1 if user-defined program n exists; 0 otherwise)
PC%	Period (.) counter (1 if the user types in a period as part of a real number; 0 otherwise)
T\$(n)	The TAG for user-defined program n
TV\$	Temporary value for arithmetic calculations
UA%(n)	Upper line limit for user program n

Note: The maximum value of m is 100, n is 5 and l is 6.

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CIRCLE NUMBER 15

An EXEC file is used to put the user-defined program into memory. The file name convention is CAL.n, where n is the program number. Every EXEC file is constructed as follows:

Statement	Meaning
DEL LA%, UA%	Delete line numbers LA% to UA%
ln statement	User-defined program lines, where ln is the line number
...	...
...	...
RUN	

When such a file is EXECed, the buffer area for the particular user-defined program is cleared and refilled with the new program lines. Finally, the RUN command re-initiates NIBBLE.CALC.

User-Defined Program Buffer Areas

The buffer areas are reserved for storing user-defined programs in memory along with NIBBLE.CALC. Each buffer area has the following structure:

Line	Statement
ln	CLEAR : GOSUB 5600
ln	User-defined program statements
...	...
ln	...
ln	GOTO 4490

The first and last lines are fixed and built into the program.

The line number ranges for the user-defined programs are:

User Program	Lines
1	3310-3510
2	3550-3750
3	3790-3990
4	4030-4230
5	4270-4470

The program editor does not allow lines outside the allocated line range.

Passing a Value to a User-Defined Program

When you run a user-defined program, the CLEAR command is executed, so that NIBBLE.CALC's variables will not interfere with variables in the user-defined program. The routine at line 5580 assigns N the value that was shown in the calculator display by PEEKing memory locations starting at 768. This area is used by the main program to store the contents of DV\$ before calling a user program in the following format: length byte, ASCII values of the characters in DV\$, duplicate length byte. The final length byte acts as a check to ensure that NIBBLE.CALC only reads valid data from this area of memory. When your program ends, a GOTO 4490 clears ERRFLG, converts the value of N to a string, POKes the string into memory at location 768 and reinitiates NIBBLE.CALC.

Turtle BASIC, Nibble Calculator and Tank Combat are available on diskette for an introductory price of \$19.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: NIBBLE.CALC

```

10 REM *****
20 REM * NIBBLE.CALC *
30 REM * BY NEWTON S. LEE *
40 REM * COPYRIGHT (C) 1986 *
50 REM * BY MICROSPARC, INC *
60 REM * CONCORD, MA 01742 *
70 REM *****

```



```

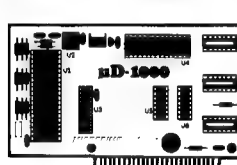
80 D$ = CHR$ (4):UL$ = CHR$ (95):LB$ = CHR$
(91)
90 DIM A$(100),LA%(5),UA%(5),P%(5),T$(5),M(6)
)
100 LA%(1) = 3310:UA%(1) = 3510:LA%(2) = 3550
:UA%(2) = 3750:LA%(3) = 3790:UA%(3) = 39
90:LA%(4) = 4030:UA%(4) = 4230:LA%(5) =
4270:UA%(5) = 4470
110 GOSUB 4850: REM - READ INFO -
120 GOSUB 4990: REM - READ MEMORY -
130 GOSUB 5210: REM - DISPLAY -
140 M% = 0
150 PI = 3.141592654
160 GOSUB 5590: GOTO 1410
170 REM
180 REM - BEGIN -
190 REM
200 GOSUB 1520: GOSUB 1730: REM -GET TV$-
210 IF LEN (TV$) > 0 THEN DV$ = TV$
220 K% = 0: ONERR GOTO 4580
230 IF C$ = "V" THEN GOSUB 1490: GET C$: GOTO
720
240 IF C$ = "S" THEN 460
250 IF C$ = "C" THEN 480
260 IF C$ = "T" THEN 500
270 IF C$ = "I" THEN 520
280 IF C$ = "R" THEN 530
290 IF C$ = "A" THEN 540
300 IF C$ = "Q" THEN 550
310 IF C$ = "X" THEN 560
320 IF C$ = "L" THEN 570
330 IF C$ = "M" THEN 580
340 IF C$ = "N" THEN 630
350 IF C$ = "O" THEN 660
360 IF C$ = "H" THEN 690
370 IF C$ = "D" THEN 1210
380 IF C$ = "K" THEN 1240
390 IF C$ = "P" THEN GOSUB 5110: GOSUB 1930
: GOSUB 5210: GOTO 1410
400 IF C$ = "#" THEN GOSUB 5110: GOSUB 2140
: GOSUB 5210: GOTO 1410
410 IF C$ = "+" OR C$ = "-" OR C$ = "*" OR C
$ = "/" THEN 1290
420 IF C$ = "=" OR C$ = CHR$ (13) THEN 200
430 IF C$ = CHR$ (27) THEN 5100
440 IF C$ = "@" THEN M% = M% + 1:M% = INT (
(M% / 2 - INT (M% / 2)) * 2 + .05)
450 PRINT CHR$ (7): GOTO 200
460 IF M% = 0 THEN DV$ = STR$ ( VAL (DV$) *
PI / 180)
470 DV$ = STR$ ( SIN ( VAL (DV$))): GOTO 141
0
480 IF M% = 0 THEN DV$ = STR$ ( VAL (DV$) *
PI / 180)
490 DV$ = STR$ ( COS ( VAL (DV$))): GOTO 141
0
500 IF M% = 0 THEN DV$ = STR$ ( VAL (DV$) *
PI / 180)
510 DV$ = STR$ ( TAN ( VAL (DV$))): GOTO 141
0
520 DV$ = STR$ ( INT ( VAL (DV$))): GOTO 141
0
530 DV$ = STR$ ( RND ( VAL (DV$))): GOTO 141
0
540 DV$ = STR$ ( ABS ( VAL (DV$))): GOTO 141
0
550 DV$ = STR$ ( SQR ( VAL (DV$))): GOTO 141
0
560 DV$ = STR$ ( EXP ( VAL (DV$))): GOTO 141
0
570 DV$ = STR$ ( LOG ( VAL (DV$))): GOTO 141
0
580 GOSUB 1730: IF LEN (TV$) = 0 THEN TV$ =
DV$
590 IF C$ = "K" THEN GOSUB 1610
600 DV = VAL (DV$):TV = VAL (TV$):DV$ = STR$
( INT ((DV / TV - INT (DV / TV)) * TV +
.05) * SGN (DV / TV))
610 IF K% = 1 THEN GOSUB 1680: GOTO 1410
620 GOTO 1450
630 DV = VAL (DV$)
640 DV$ = STR$ (( EXP (DV) - EXP ( - DV)) /
2)
650 GOTO 1410
660 DV = VAL (DV$)

```

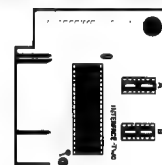
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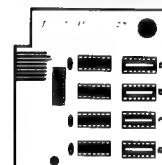
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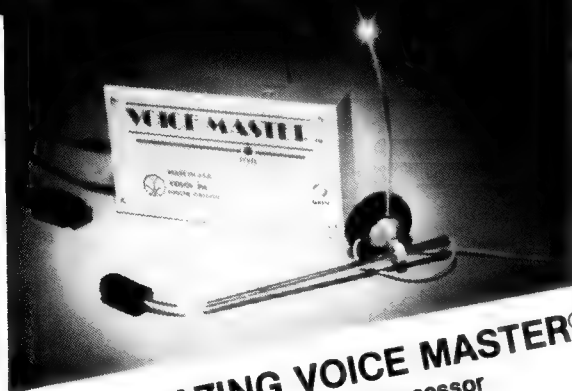
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LISTING 1: NIBBLE.CALC (continued)

```

670 DV$ = STR$ (( EXP (DV) + EXP ( - DV)) /
2)
680 GOTO 1410
690 DV = VAL (DV$)
700 DV$ = STR$ ( - EXP ( - DV) / ( EXP (DV)
+ EXP ( - DV)) * 2 + 1)
710 GOTO 1410
720 IF C$ = "S" THEN 860
730 IF C$ = "C" THEN 900
740 IF C$ = "T" THEN 940
750 IF C$ = "I" THEN 960
760 IF C$ = "R" THEN 970
770 IF C$ = "A" THEN 990
780 IF C$ = "Q" THEN 1040
790 IF C$ = "X" THEN 1050
800 IF C$ = "L" THEN 1060
810 IF C$ = "M" THEN 1070
820 IF C$ = "N" THEN 1120
830 IF C$ = "O" THEN 1150
840 IF C$ = "H" THEN 1180
850 GOTO 200
860 DV = VAL (DV$): IF DV = 1 THEN DV$ = STR$
(1.570796327): GOTO 880
870 DV$ = STR$ ( ATN (DV / SQR ( - DV * DV +
1)))
880 IF M% = 0 THEN DV$ = STR$ ( VAL (DV$) *
180 / PI)
890 GOTO 1410
900 DV = VAL (DV$): IF DV = 1 THEN DV$ = STR$
(0): GOTO 920
910 DV$ = STR$ ( - ATN (DV / SQR ( - DV *
DV + 1)) + 1.5708)
920 IF M% = 0 THEN DV$ = STR$ ( VAL (DV$) *
180 / PI)
930 GOTO 1410
940 DV$ = STR$ ( ATN ( VAL (DV$))): IF M% =
0 THEN DV$ = STR$ ( VAL (DV$) * 180 / P
I)
950 GOTO 1410
960 DV$ = STR$ (1 / VAL (DV$)): GOTO 1410
970 DV = 1: FOR I = 1 TO VAL (DV$): DV = DV *
I: NEXT DV$ = STR$ (DV)
980 GOTO 1410
990 GOSUB 1730: IF LEN (TV$) = 0 THEN TV$ =
DV$
1000 IF C$ = "K" THEN GOSUB 1610
1010 DV$ = STR$ ( VAL (DV$) ^ VAL (TV$))
1020 IF K% = 1 THEN GOSUB 1680: GOTO 1410
1030 GOTO 1450
1040 DV$ = STR$ ( VAL (DV$) * VAL (DV$)): GOTO
1410
1050 DV$ = STR$ ( LOG ( VAL (DV$)) / LOG (1
0)): GOTO 1410
1060 DV$ = STR$ (10 ^ VAL (DV$)): GOTO 1410
1070 GOSUB 1730: IF LEN (TV$) = 0 THEN TV$ =
DV$
1080 IF C$ = "K" THEN GOSUB 1610
1090 DV$ = STR$ ( VAL (DV$) ^ (1 / VAL (TV$
)))
1100 IF K% = 1 THEN GOSUB 1680: GOTO 1410
1110 GOTO 1450
1120 DV = VAL (DV$)
1130 DV$ = STR$ ( LOG (DV + SQR (DV * DV +
1)))
1140 GOTO 1410
1150 DV = VAL (DV$)
1160 DV$ = STR$ ( LOG (DV + SQR (DV * DV -
1)))
1170 GOTO 1410
1180 DV = VAL (DV$)
1190 DV$ = STR$ ( LOG ((1 + DV) / (1 - DV)) /
2)
1200 GOTO 1410
1210 HTAB 22: FOR I = 1 TO 15: PRINT " ": NEXT
I
1220 HTAB 22: PRINT "0": DV$ = "0"
1230 GOTO 200
1240 COL% = POS (0): VTAB 14: HTAB 28: FLASH
: PRINT "K": NORMAL: VTAB 11: HTAB COL
% + 1: GET C$: COL% = POS (0): VTAB 14: HTAB
28: INVERSE: PRINT "K": NORMAL: VTAB
11: HTAB COL% + 1: IF C$ < > "S" AND C$
< > "R" THEN PRINT CHR$ (7): GOTO 2
00

```



```

1250 COL% = POS (0): VTAB 14: HTAB 30 + 4 *
(C$ = "R"): FLASH : PRINT C$;: NORMAL : VTAB
11: HTAB COL% + 1: GET N$: VTAB 14: HTAB
30 + 4 * (C$ = "R"): INVERSE : PRINT C$;
: NORMAL : VTAB 11: HTAB COL% + 1: IF N$
< "1" OR N$ > "6" THEN PRINT CHR$ (7)
: GOTO 200
1260 IF C$ = "S" THEN M( VAL (N$)) = VAL (D
V$)
1270 IF C$ = "R" THEN DV$ = STR$ (M( VAL (N
$)))
1280 GOSUB 5520: GOTO 1410
1290 TC$ = C$: GOSUB 1730: IF LEN (TV$) = 0 THEN
TV$ = DV$
1300 IF C$ = "K" THEN GOSUB 1610
1310 IF TC$ = "+" THEN DV$ = STR$ ( VAL (DV
$) + VAL (TV$))
1320 IF TC$ = "-" THEN DV$ = STR$ ( VAL (DV
$) - VAL (TV$))
1330 IF TC$ = "*" THEN DV$ = STR$ ( VAL (DV
$) * VAL (TV$))
1340 IF TC$ = "/" THEN DV$ = STR$ ( VAL (DV
$) / VAL (TV$))
1350 IF K% = 1 THEN GOSUB 1680: GOTO 1410
1360 GOTO 1450
1370 CALL - 3288: POKE 216,0: HOME : VTAB 1
2: PRINT "ERROR #" PEEK (222) IN LINE "
PEEK (218) + 256 * PEEK (219): PRINT :
INPUT "DO YOU WANT TO TRY AGAIN? ";YN$:
ON (YN$ = "Y") GOTO 5110: RETURN
1380 REM
1390 REM - DISPLAY DV$ -
1400 REM
1410 PC% = 0:EC% = 0: VTAB 11: HTAB 22: PRINT
DV$;
1420 IF LEN (DV$) = 15 THEN 200
1430 FOR I = 1 TO 15 - LEN (DV$): PRINT " "
: NEXT
1440 GOTO 200
1450 PC% = 0:EC% = 0: VTAB 11: HTAB 22: PRINT
DV$;

```

```

1460 IF LEN (DV$) = 15 THEN 220
1470 FOR I = 1 TO 15 - LEN (DV$): PRINT " "
: NEXT
1480 HTAB 22: GOTO 220
1490 COL% = POS (0)
1500 VTAB 4: HTAB 2: PRINT " ";; HTAB 7: FLASH
: PRINT ">>";: NORMAL : VTAB 11: HTAB CO
L% + 1
1510 RETURN
1520 COL% = POS (0)
1530 VTAB 4: HTAB 2: INVERSE : PRINT "<<";: NORMAL
: HTAB 7: PRINT " ";;
1540 IF M% = 0 THEN VTAB 23: HTAB 28: INVERSE
: PRINT "DEG";: NORMAL : PRINT " RAD";
1550 IF M% = 1 THEN VTAB 23: HTAB 28: NORMAL
: PRINT "DEG ";: INVERSE : PRINT "RAD";
1560 NORMAL : VTAB 11: HTAB COL% + 1
1570 RETURN
1580 REM
1590 REM - HANDLE K STO/RCL REQ -
1600 REM
1610 COL% = POS (0): VTAB 14: HTAB 28: FLASH
: PRINT "K";: NORMAL : VTAB 11: HTAB COL
% + 1: GET C$:COL% = POS (0): VTAB 14: HTAB
28: INVERSE : PRINT "K";: NORMAL : VTAB
11: HTAB COL% + 1: IF C$ < > "R" AND C$
< > "S" THEN PRINT CHR$ (7);:K% = 0:
RETURN
1620 COL% = POS (0): VTAB 14: HTAB 30 + 4 *
(C$ = "R"): FLASH : PRINT C$;: NORMAL : VTAB
11: HTAB COL% + 1: GET N$: VTAB 14: HTAB
30 + 4 * (C$ = "R"): INVERSE : PRINT C$;
: NORMAL : VTAB 11: HTAB COL% + 1: IF N$
< "1" OR N$ > "6" THEN PRINT CHR$ (7)
:K% = 0: RETURN
1630 IF C$ = "S" THEN K% = 1:C$ = CHR$ (13)
: RETURN
1640 IF C$ = "R" THEN TV$ = STR$ (M( VAL (N
$))) :K% = 0:C$ = CHR$ (13): RETURN
1650 REM
1660 REM - HANDLE K STO -

```

continued on page 51

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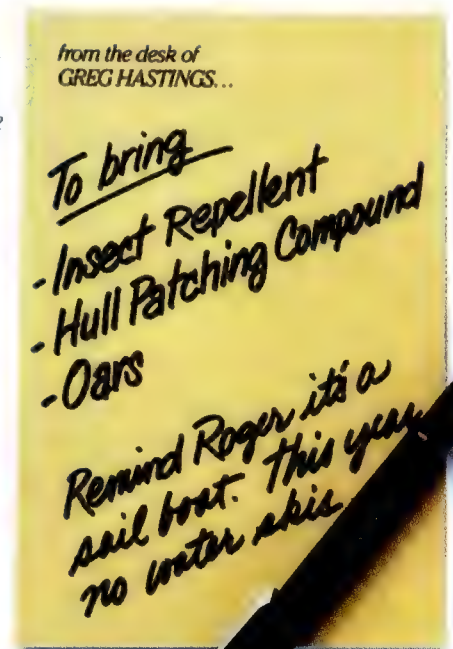


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Don't spend hours addressing envelopes and misspelling names. Pinpoint picks up names and addresses from invitations (or any documents) and drops them, letter perfect, onto envelopes. Even if you don't always spell those tongue-twisting names right, at least you'll be consistent.



Jot down important thoughts whenever they strike. The note pad is perfect for reminding you of things you can't do without. Or things you can.



Impress a friend with a personal invitation. It's easy. The automatic dialer finds phone numbers displayed anywhere on the screen, not just in special files.

And it re-dials busy numbers automatically. So you're next in line as soon as your friend's broker hangs up.

Accessories. \$69.

Nine accessories to be precise. And in no time, they'll be so much a part of your AppleWorks routine, you'll think of them as built-in, not added-on. Why?

For openers, these handy desktop timesavers "pop-up" via windows from inside AppleWorks (*and most other ProDOS programs*). So you can stop what you're doing to jot down a note, address a letter, or call a friend.

You can even figure out some figures with our calculator. Tap data bases or other computers through our communications window. Even whip out short memos, forms and labels with our line-at-a-time typewriter. And then continue AppleWorks without missing a beat. Or a byte.

What's more, Pinpoint's as easy to use as AppleWorks itself. Same commands. Same hardware.

Plus you can boost Pinpoint's performance by adding an Apple Extended Memory Card, the new, high-capacity UniDisk 3.5 floppy, a hard disk, a modem, or one of many popular printers. And with our Pinpoint Toolkit, you can even add desktop accessories of your own.

Want more?

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64K RAMWORKS, AppleWorks Expander, Pinpoint, plus 256K RAM	\$278.00
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1Meg RAMWORKS, AppleWorks Expander Software, plus Pinpoint	\$408.00
256K Z-RAM, AppleWorks Expander Software, plus Pinpoint	\$418.00
512 Z-RAM, AppleWorks Expander Software, plus Pinpoint	\$468.00

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Prometheus 300c, Compact 300 Baud External Mounts on the IIc		\$208.00
Volsmodem 1200, 1200 Baud External	IIc/IIe*/MAC*/IBM*	\$238.00
ZOOM IIe, 300 Baud Internal	IIe/Enhanced IIe	\$188.00

*Requires \$10-15 cable and/or serial interface card. Subject to availability and price changes.
Most items available from your dealer.

Add the convenience of an appointment calendar, a telecommunications window, graphic and text merging, and six other desktop accessories to your AppleWorks program.

Pinpoint

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Author: Sandy Mossberg
System Requirements: Applesoft compatibility and DOS 3.3
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LISTING 1: NIBBLE.CALC (continued)

```

1670 REM
1680 M( VAL (N$)) = VAL (DV$): GOSUB 5520
1690 RETURN
1700 REM
1710 REM - GET TV$ -
1720 REM
1730 VTAB 11: HTAB 22:TV$ = "":PC% = 0:EC% =
0
1740 GET C$
1750 IF (C$ < "0" OR C$ > "9") AND C$ < > "
" AND C$ < > CHR$(8) AND C$ < > "E"
AND C$ < > "U" THEN RETURN
1760 IF LEN (TV$) = 15 THEN 1810
1770 IF (C$ > = "0" AND C$ < = "9") OR (C$
= "." AND PC% = 0 AND EC% = 0) OR (C$ =
"E" AND EC% = 0) THEN PRINT C$;TV$ = T
V$ + C$: IF POS (0) = 22 THEN GOSUB 18
80:TV$ = C$: PRINT C$;
1780 IF C$ = "U" AND ( LEN (TV$) = 0 OR RIGHT$
(TV$,1) = "E") THEN PRINT "-";TV$ = TV
$ + "-": IF POS (0) = 22 THEN GOSUB 18
80:TV$ = "-": PRINT "-";
1790 IF C$ = "E" AND EC% = 0 THEN EC% = 1
1800 IF C$ = "." AND EC% = 0 AND PC% = 0 THEN
PC% = 1
1810 IF C$ < > CHR$(8) OR LEN (TV$) = 0 THEN
1740
1820 PRINT CHR$(8);: PRINT " ";: PRINT CHR$(
8);
1830 IF RIGHT$ (TV$,1) = "E" THEN EC% = 0
1840 IF RIGHT$ (TV$,1) = "." THEN PC% = 0
1850 IF LEN (TV$) = 1 THEN TV$ = ""
1860 IF LEN (TV$) > 1 THEN TV$ = LEFT$ (TV
$, LEN (TV$) - 1)
1870 GOTO 1740
1880 FOR I = 1 TO 15: PRINT " ";: NEXT : HTAB
22
1890 RETURN
1900 REM
1910 REM - RUN PROGRAM -
1920 REM
1930 HOME : VTAB 2: HTAB 15: INVERSE : PRINT
" RUN PROGRAM ": NORMAL
1940 J = 1
1950 FOR I = 1 TO 5
1960 J = J + 3: VTAB J: HTAB 1
1970 IF P%(I) = 1 THEN INVERSE : PRINT " ";
: NORMAL
1980 IF P%(I) = 0 THEN PRINT " ";
1990 PRINT " PROGRAM ":I
2000 PRINT " TAG = ";T$(I)
2010 NEXT
2020 PRINT : INVERSE : PRINT " ";: NORMAL : PRINT
" <ESC> TO QUIT"
2030 VTAB 22: HTAB 1: PRINT " PROGRAM";LB$;
"1-5): ";: GET N$: PRINT N$;
2040 IF N$ = CHR$(27) THEN RETURN
2050 N = VAL (N$): IF N < 1 OR N > 5 THEN PRINT
CHR$(7);: GOTO 2030
2060 IF P%(N) = 0 THEN 2090
2070 HOME : ONERR GOTO 4550
2080 ON N GOTO 3300,3540,3780,4020,4260
2090 VTAB 22: HTAB 2: FLASH : PRINT CHR$(7
);" PROGRAM ";N;" IS EMPTY ": NORMAL
2100 FOR I = 1 TO 500: NEXT I: RETURN
2110 REM
2120 REM - PROGRAMMING ROUTINE -
2130 REM
2140 HOME : INVERSE : VTAB 1: HTAB 15: PRINT
" PROGRAMMING ": NORMAL
2150 J = 1
2160 FOR I = 1 TO 5
2170 J = J + 3: VTAB J: HTAB 1
2180 IF P%(I) = 1 THEN INVERSE : PRINT " ";
: NORMAL
2190 IF P%(I) = 0 THEN PRINT " ";
2200 PRINT " PROGRAM ":I
2210 PRINT " TAG = ";T$(I)
2220 NEXT
2230 PRINT : INVERSE : PRINT " ";: NORMAL : PRINT
" <ESC> TO QUIT"
2240 VTAB 22: HTAB 1: PRINT " PROGRAM";LB$;
"1-5): ";: GET N$: PRINT N$;
2250 IF N$ = CHR$(27) THEN RETURN

```

```

2260 N = VAL (N$): IF N < 1 OR N > 5 THEN PRINT
CHR$(7);: GOTO 2240
2270 IF P%(N) = 0 THEN GOSUB 2320: GOTO 303
0
2280 IF P%(N) = 1 THEN GOSUB 2460: RETURN
2290 REM
2300 REM - ENTER NEW PROGRAM -
2310 REM
2320 HOME : INPUT "TAG = ";T$(N): IF LEN (T
$(N)) > 70 THEN T$(N) = LEFT$ (T$(N),70
)
2330 HOME : INVERSE : PRINT "ENTER YOUR PROG
RAM #";N;" : ";LB$;" : ";LA%(N);"-";UA%(N);"
]"
2340 PRINT LB$;" BLANK LINE = FINISH; Q = QU
IT ]": NORMAL
2350 I = 1:P%(N) = 1
2360 INPUT " ";A$(I)
2370 IF LEFT$ (A$(I),1) = "Q" THEN RUN
2380 IF LEN (A$(I)) = 0 THEN RETURN
2390 IF VAL (A$(I)) < LA%(N) OR VAL (A$(I)
) > UA%(N) THEN PRINT CHR$(7);"LINE N
UM OUT OF RANGE ";LB$;" : ";LA%(N);"-";UA%(
N);"]": PRINT "RETYPE LINE:";I = I - 1
2400 IF I = 100 THEN RETURN
2410 I = I + 1
2420 GOTO 2360
2430 REM
2440 REM - EDIT OLD PROGRAM -
2450 REM
2460 HOME
2470 VTAB 1: HTAB 1: INVERSE : PRINT "EDIT>
L(IST T(AG C(HANGE E(RASE Q(UIT ";: NORMAL
: GET C$: PRINT C$;
2480 IF C$ < > "L" THEN 2560
2490 HOME
2500 ON N GOTO 2510,2520,2530,2540,2550
2510 LIST 3310,3510: GOTO 2470
2520 LIST 3550,3750: GOTO 2470
2530 LIST 3790,3990: GOTO 2470
2540 LIST 4030,4230: GOTO 2470
2550 LIST 4270,4470: GOTO 2470
2560 IF C$ < > "C" THEN 2760
2570 HOME : INVERSE : PRINT "CHANGE> ENTER L
INE(S): ";LB$;" : ";LA%(N);"-";UA%(N);"]"
2580 PRINT LB$;" BLANK LINE = FINISH; Q = QU
IT ]": NORMAL
2590 GOSUB 2350
2600 PRINT D$;"OPEN CAL." + N$
2610 PRINT D$;"CLOSE CAL." + N$: PRINT D$;"D
ELETE CAL." + N$
2620 PRINT D$;"OPEN CAL." + N$
2630 PRINT D$;"WRITE CAL " + N$
2640 PRINT "DEL " + STR$ (LA%(N)) + "." + STR$
(UA%(N))
2650 IF N = 1 THEN LIST 3310,3510
2660 IF N = 2 THEN LIST 3550,3750
2670 IF N = 3 THEN LIST 3790,3990
2680 IF N = 4 THEN LIST 4030,4230
2690 IF N = 5 THEN LIST 4270,4470
2700 FOR J = 1 TO I
2710 PRINT A$(J)
2720 NEXT
2730 PRINT "RUN"
2740 PRINT D$;"CLOSE CAL." + N$
2750 GOTO 3220
2760 IF C$ < > "E" THEN 2910
2770 HOME : PRINT "ERASE> READY TO ERASE PRO
GRAM #";N: PRINT "PRESS <RETURN> TO CONF
IRM DELETION": PRINT " OR <ESC> TO REJ
ECT DELETION"
2780 GET C$
2790 IF C$ < > CHR$(13) AND C$ < > CHR$(
27) THEN PRINT CHR$(7);: GOTO 2770
2800 PRINT C$;
2810 IF C$ = CHR$(27) THEN HOME : GOTO 24
70
2820 D$ = CHR$(4)
2830 PRINT D$;"OPEN CAL." + N$
2840 PRINT D$;"CLOSE CAL." + N$: PRINT D$;"D
ELETE CAL." + N$
2850 P%( VAL (N$)) = 0:T$( VAL (N$)) = ""
2860 PRINT D$;"OPEN CAL.INFO"
2870 PRINT D$;"WRITE CAL.INFO"
2880 FOR I = 1 TO 5: PRINT P%(I): PRINT T$(I
): NEXT

```

continued on next page

LISTING 1: NIBBLE.CALC (continued)

```

2890 PRINT D$;"CLOSE CAL.INFO"
2900 RUN
2910 IF C$ < > "Q" THEN 2930
2920 RETURN
2930 IF C$ < > "T" THEN PRINT CHR$(7):: GOTO
2470
2940 HOME : INPUT "TAG = ":T$(N)
2950 PRINT D$;"OPEN CAL.INFO"
2960 PRINT D$;"WRITE CAL.INFO"
2970 FOR L = 1 TO 5: PRINT P%(L): PRINT T$(L
): NEXT
2980 PRINT D$;"CLOSE CAL.INFO"
2990 GOTO 2470
3000 REM
3010 REM - SAVE PROGRAM -
3020 REM
3030 PRINT D$;"OPEN CAL." + N$
3040 PRINT D$;"CLOSE CAL." + N$: PRINT D$;"D
ELETE CAL." + N$
3050 PRINT D$;"OPEN CAL." + N$
3060 PRINT D$;"WRITE CAL." + N$
3070 PRINT "DEL " + STR$(LA%(N)) + "." + STR$(
UA%(N))
3080 FOR J = 1 TO I - 1
3090 PRINT A$(J)
3100 NEXT
3110 PRINT "RUN"
3120 PRINT D$;"CLOSE CAL." + N$
3130 PRINT D$;"OPEN CAL.INFO"
3140 PRINT D$;"WRITE CAL.INFO"
3150 FOR J = 1 TO 5
3160 PRINT P%(J): PRINT T$(J)
3170 NEXT
3180 PRINT D$;"CLOSE CAL.INFO"
3190 REM
3200 REM -- SCHEDULE EXEC --
3210 REM
3220 PRINT D$;"EXEC CAL." + N$
3230 END
3270 REM
3280 REM - BUFFER AREA BEGINS -
3290 REM -1-
3300 CLEAR : GOSUB 5590
3520 GOTO 4490
3530 REM -2-
3540 CLEAR : GOSUB 5590
3760 GOTO 4490
3770 REM -3-
3780 CLEAR : GOSUB 5590
4000 GOTO 4490
4010 REM -4-
4020 CLEAR : GOSUB 5590
4240 GOTO 4490
4250 REM -5-
4260 CLEAR : GOSUB 5590
4480 GOTO 4490
4490 PRINT PRINT "PRESS ANY KEY TO CONTINU
E " : GET K$
4500 PRINT K$.
4510 POKE 216,0: GOSUB 5620 RUN
4520 REM
4530 REM - HANDLE ERROR -
4540 REM
4550 L = PEEK (218) + PEEK (219) * 256
4560 PRINT CHR$(7);"ERROR IN LINE NUMBER "
.L
4570 GOSUB 4600 PRINT E$: GOTO 4790
4580 HTAB 21: GOSUB 4600: PRINT CHR$(7). LEFT$(
E$,16):: GET C$
4590 HTAB 21 FOR I = 1 TO 16: PRINT " ": NEXT
: HTAB 22: CALL - 3288 GOTO 160
4600 E = PEEK (222)
4610 IF E = 0 THEN E$ = "NEXT WITHOUT FOR"
4620 IF E = 16 THEN E$ = "SYNTAX ERROR "
4630 IF E = 22 THEN E$ = "RETURN WITHOUT GOS
UB"
4640 IF E = 42 THEN E$ = "OUT OF DATA "
: REM 6 SPACES
4650 IF E = 53 THEN E$ = "ILLEGAL QUANTITY"
4660 IF E = 69 THEN E$ = "OVERFLOW "
: REM 8 SPACES
4670 IF E = 77 THEN E$ = "OUT OF MEMORY "
4680 IF E = 90 THEN E$ = "UNDEFINED STATEMEN
T"

```

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4690 IF E = 107 THEN E$ = "BAD SUBSCRIPT "
4700 IF E = 120 THEN E$ = "REDIMENSIONED ARR
AY"
4710 IF E = 133 THEN E$ = "DIVISION BY ZERO"
4720 IF E = 163 THEN E$ = "TYPE MISMATCH "
4730 IF E = 176 THEN E$ = "STRING TOO LONG"
4740 IF E = 191 THEN E$ = "FORMULA TOO COMPL
EX"
4750 IF E = 224 THEN E$ = "UNDEFINED FUNCTIO
N"
4760 IF E = 254 THEN E$ = "BAD RESPONSE TO A
N INPUT STATEMENT"
4770 POKE 216,0
4780 RETURN
4790 PRINT : PRINT : PRINT "PRESS ANY KEY TO
CONTINUE " : GET K$
4800 PRINT K$
4810 RUN
4820 REM
4830 REM - READ INFO -
4840 REM
4850 ONERR GOTO 4940
4860 PRINT D$;"OPEN CAL.INFO"
4870 PRINT D$;"READ CAL.INFO"
4880 FOR J = 1 TO 5
4890 INPUT P%(J)
4900 INPUT T$(J)
4910 NEXT
4920 PRINT D$;"CLOSE CAL.INFO"
4930 RETURN
4940 CALL - 3288: POKE 216,0: PRINT D$;"CLOS
E CAL.INFO": PRINT D$;"DELETE CAL.INFO": IF
PEEK (222) = 5 THEN PRINT D$;"OPEN CAL.
INFO": PRINT D$;"WRITE CAL.INFO": FOR I =
1 TO 5: PRINT 0: PRINT " ": NEXT : PRINT
D$;"CLOSE CAL.INFO": GOTO 4850
4950 HOME : VTAB 12: PRINT "ERROR #" PEEK (2
22) " IN LINE " PEEK (218) + PEEK (219) *
256: END
4960 REM
4970 REM - READ MEMORY -
4980 REM
4990 ONERR GOTO 5050
5000 PRINT D$;"OPEN CAL MEMORY"
5010 PRINT D$;"READ CAL MEMORY"
5020 FOR I = 1 TO 6: INPUT M(I): NEXT
5030 PRINT D$;"CLOSE CAL MEMORY"
5040 RETURN
5050 CALL - 3288: POKE 216,0: PRINT D$;"CLOS
E CAL MEMORY": PRINT D$;"DELETE CAL MEMOR
Y": IF PEEK (222) = 5 THEN PRINT D$;"OP
EN CAL MEMORY": PRINT D$;"WRITE CAL MEMOR
Y": FOR I = 1 TO 6: PRINT 0: NEXT PRINT
D$;"CLOSE CAL MEMORY": GOTO 4990
5060 HOME : VTAB 12: PRINT "ERROR #" PEEK (2
22) " IN LINE " PEEK (218) + 256 * PEEK
(219) END
5070 REM
5080 REM -SAVE MEMORY & PROGS-
5090 REM
5100 HOME : VTAB 10: INPUT "ARE YOU SURE YOU
WANT TO QUIT? ":Y$: ON Y$ < > "Y" GOTO
130: GOSUB 5110 GOTO 5170
5110 ONERR GOTO 1370
5120 PRINT : PRINT D$;"OPEN CAL MEMORY"
5130 PRINT D$;"WRITE CAL MEMORY"
5140 FOR I = 1 TO 6: PRINT M(I) NEXT
5150 PRINT D$;"CLOSE CAL MEMORY"
5160 PRINT D$;"SAVE NIBBLE CALC" POKE 216,0
: RETURN
5170 HOME END
5180 REM
5190 REM - CALC DISPLAY -
5200 REM
5210 HOME
5220 PRINT " ". INVERSE PRINT " NIBBLE CA
LCULATOR ": NORMAL : PRINT " BY NEWTON
S LEE" : PRINT " ** COPYRIGHT 1986 BY MIC
ROSPARC. INC ."
5230 PRINT : INVERSE : HTAB 5: PRINT "V": NORMAL
5240 PRINT : INVERSE PRINT "S". NORMAL PRINT
"IN ".LB$;"ARCSIN"]
5250 INVERSE : PRINT "C": NORMAL : PRINT "O
S ".LB$;"ARCCOS"]

```

continued on page 54

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Dallas, Texas 75240

LISTING 1: NIBBLE.CALC (continued)

```

5260 INVERSE : PRINT "T": NORMAL : PRINT "A
      N ":LB$:"ARCTAN]"
5270 PRINT "E": INVERSE : PRINT "X": NORMAL
      : PRINT "P ":LB$:"LOG10]"
5280 INVERSE : PRINT "L": NORMAL : PRINT "O
      G ":LB$:"10^X]"
5290 PRINT "S": INVERSE : PRINT "Q": NORMAL
      : PRINT "RT ":LB$:"X^2]"
5300 INVERSE : PRINT "A": NORMAL : PRINT "B
      S ":LB$:"X^Y]"
5310 INVERSE : PRINT "M": NORMAL : PRINT "O
      D ":LB$:"X^1/Y]"
5320 INVERSE : PRINT "I": NORMAL : PRINT "N
      T ":LB$:"1/X]"
5330 INVERSE : PRINT "R": NORMAL : PRINT "N
      D ":LB$:"X!"
5340 PRINT "SI": INVERSE : PRINT "N": NORMAL
      : PRINT "H ":LB$:"ARCSINH]"
5350 PRINT "C": INVERSE : PRINT "O": NORMAL
      : PRINT "SH ":LB$:"ARCCOSH]"
5360 PRINT "TAN": INVERSE : PRINT "H": NORMAL
      : PRINT " ":LB$:"ARCTANH]"
5370 PRINT : PRINT : INVERSE : PRINT "U": NORMAL
      : PRINT "NARY MINUS"
5380 PRINT : PRINT "CLEAR DISPLAY": INVERSE
      : PRINT "D": NORMAL
5390 PRINT : PRINT "<ESC> TO QUIT"
5400 VTAB 4: HTAB 20: PRINT "PROGRAM: ": INVERSE
      : PRINT "P": NORMAL : PRINT " ": INVERSE
      : PRINT "#": NORMAL
5410 VTAB 6: HTAB 20
5420 FOR I = 1 TO 5: PRINT "":I:
5430 IF P%(I) = 1 THEN INVERSE : PRINT " ":
      : NORMAL
5440 IF P%(I) = 0 THEN PRINT UL$:
5450 PRINT " ": NEXT
5460 VTAB 8: HTAB 20: PRINT "DISPLAY:": PRINT

5470 INVERSE : HTAB 20: FOR I = 20 TO 38: PRINT
      " ": NEXT : PRINT

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```

5480 HTAB 20: PRINT " ": HTAB 38: PRINT " "
5490 HTAB 20: FOR I = 20 TO 38: PRINT " ": NEXT
      : PRINT : NORMAL
5500 PRINT : HTAB 20: PRINT "MEMORY:":
5510 HTAB 28: INVERSE : PRINT "K": HTAB 30:
      PRINT "S": NORMAL : PRINT "TO ": INVERSE
      : PRINT "R": NORMAL : PRINT "CL"
5520 VTAB 16: FOR I = 1 TO 6: HTAB 20: PRINT
      "":I:
5530 FOR II = 1 TO 15: PRINT UL$: NEXT
5540 IF M(I) < > 0 THEN HTAB 22: PRINT M(I
      ):
5550 PRINT : NEXT
5560 PRINT : HTAB 20: INVERSE : PRINT "@": NORMAL
      : PRINT " MODE: DEG RAD":
5570 RETURN
5580 REM READ DV$ VALUE FORM PAGE 3
5590 DV$ = "":L = PEEK (768): IF L < 1 OR L >
      13 OR L < > PEEK (769 + L) THEN N = 0:
      DV$ = "0": RETURN
5600 FOR I = 1 TO L:DV$ = DV$ + CHR$ ( PEEK
      (768 + I)): NEXT : POKE 768,255:N = VAL
      (DV$): RETURN
5610 REM STORE DV$ ON PAGE 3
5620 DV$ = STR$(N):L = LEN (DV$): POKE 768
      ,L: FOR I = 1 TO L: POKE 768 + I, ASC ( MID$
      (DV$,I,1)): NEXT : POKE 769 + L,L: RETURN

```

END OF LISTING 1

KEY PERFECT 5.0 RUN ON NIBBLE.CALC

CODE-5.0	LINE#	LINE#	CODE-4.0
8E1DC7C1	10	100	A618
9FB85120	110	200	498B
48BD11BF	210	300	4ABE
30C3962A	310	400	5398
E30A5B6E	410	500	87F0
490DE3EE	510	600	835C
F104043F	610	700	493B
093F2542	710	800	3BD6
CC6C06D0	810	900	5DE2
7AA67F35	910	1000	7158
0248DB98	1010	1100	6DBA
C5C34956	1110	1200	4400
A60B4434	1210	1300	C067
59D00C7A	1310	1400	8DF3
CAB19AB7	1410	1500	6269
972ABA1C	1510	1600	5087
A1F51793	1610	1700	84A6
679AE5F0	1710	1800	A5C3
00084F67	1810	1900	5339
9AB1FECF	1910	2000	3E68
A39649F5	2010	2100	711B
E277F43E	2110	2200	41B1
E3392B7E	2210	2300	5C9B
3DC984F	2310	2400	9FC9
8FE42444	2410	2500	4D31
732871F1	2510	2600	7284
3111BC1A	2610	2700	64FB
B9E0EFEE	2710	2800	65EB
DBE0DAFB	2810	2900	6548
2F76E076	2910	3000	4B63
5DAAB77E	3010	3100	583F
990BACF5	3110	3200	49D1
2D92D342	3210	3540	2B20
98D704C9	3760	4480	257A
7AF4F848	4490	4580	59BD
ADD6A696	4590	4680	83E2
A4BD0D2D	4690	4780	7CC0
0F2EFD83	4790	4880	3C04
20CC186E	4890	4980	8264
EF325A6C	4990	5080	9BB0
590A76CC	5090	5180	6129
A834E213	5190	5280	881E
56080564	5290	5380	A14D
3A77E5E9	5390	5480	5FDD
FEA6A2AF	5490	5580	682E
0A7700CB	5590	5620	5DD8
352E16D5	= PROGRAM TOTAL =		2961

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N DOUBLEWIDE EMPHASIZED
O DOUBLEWIDE EMPHASIZED DOUBLESTRIKE
P CONDENSED DOUBLEWIDE
Q CONDENSED DOUBLEWIDE DOUBLESTRIKE
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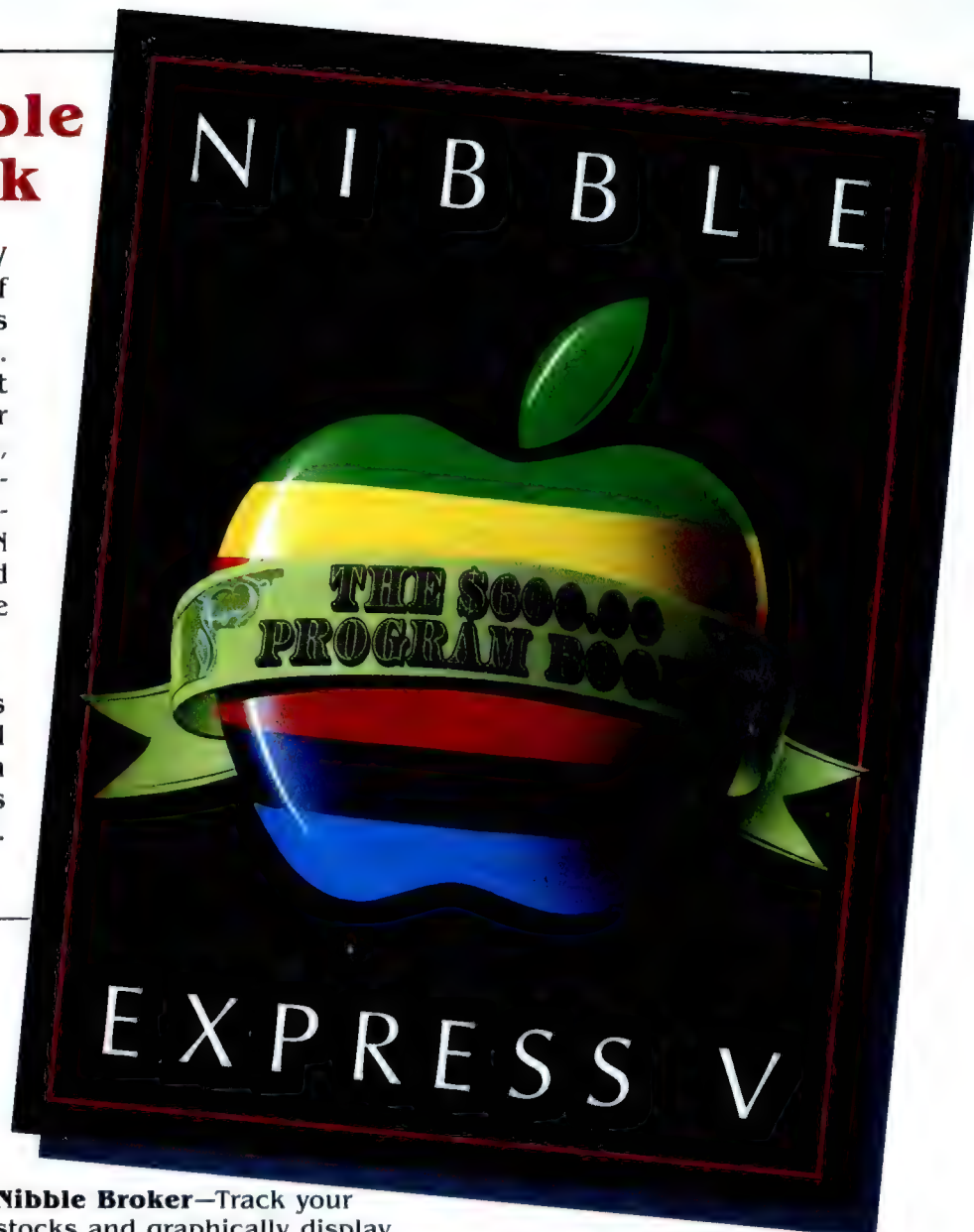
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TANK COMBAT

FEATURED GAME

by Rudy A. Guy

This Hi-Res graphics strategy game pits you against the computer in deadly tank combat. You control six tanks to defend your headquarters.

It happened one cold, winter day — my joystick died. I couldn't shoot invading aliens or defend space ports. My favorite action games were useless, as blank as the empty monitor screen. I stared at it dully. A snowy Sunday afternoon is no time to lose your joystick. In desperation I turned on the television.

The local cable station was running a vintage World War II movie. Real war. Footage of tanks overrunning the French countryside and soldiers

marching in formation. The tanks were everywhere — barrelling down country lanes, plowing through thick hedges, lurching over ditches. Tanks blowing up, tanks firing ammunition at an invisible enemy. Then it came to me — Tank Combat, the tank warfare of the 21st century!

Tank Combat is a strategy game that pits you against the computer in an all-out struggle. You control six tanks that are about to be attacked by the invading computer-controlled tanks. Your goal is to wipe out all the computer tanks before they annihilate your forces. A game in progress is shown in Figure 1. Tank Combat does not use paddles or

Rudy A. Guy, 1114 West 22nd St., Erie, PA 16502. Tank Combat is compatible with DOS 3.3 and ProDOS.

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joysticks. Leave out the sound routine and you can sneak in games at the office.

PLAYING THE GAME

When TANK.COMBAT is run, the computer draws the 16 by 18 playing grid and places 28 anti-tank barriers on it — 14 in the top half and 14 in the bottom. Next, in the top half of the grid (rows 1-8) the computer places its headquarters (HQ), ammo dump (AD) and fuel depot (FD), and hides six anti-tank mines. The computer's six tanks are then positioned in the top three rows of the grid. Then you can place your HQ, fuel depot, ammo dump and anti-tank mines anywhere on the lower half of the grid (rows 9-16). Your six tanks, however, must start the game in rows 14-16.

Tanks have an armor rating of one to six, with six the most vulnerable and one the strongest. The armor rating is the same as the number of the tank. When all the pieces have been placed on the game grid, the action begins.

Placing Shots

Each round begins when the computer player places its shots in secret locations. Then you place your shots and move your tanks. After the computer moves its tanks, the positions of its shots are revealed one by one, and you are informed of any damage they inflict. Finally, your shots are displayed in the same manner. Tanks and barriers are always destroyed when hit; mines are destroyed randomly at a 50/50 rate; HQ's, ammo dumps, and fuel depots can only be destroyed when overrun by a tank.

Placing a shot is accomplished by first moving the solid square using the I, J, K, and M keys, and then entering its position by pressing the space bar. Shots may be placed anywhere on the board, except where you have already placed shots for that round.

Each player starts with six shots per round, but this number is decreased if the player's HQ or ammo dump is overrun. If the ammo dump is overrun, then the number of shots is reduced to one shot per tank. If the HQ is overrun, the total is cut in half. For instance, a player with four tanks and no ammo dump gets four shots, and a player with an ammo dump and any number of tanks, but no HQ, gets three shots.

Moving Tanks

Each tank that hasn't been destroyed may be moved, starting with your number one tank and ending with number six. The total number of remaining moves is displayed at the bottom of the screen. One tank move is a move in either the horizontal or vertical direction. A diagonal move takes two moves — one horizontal and one verti-

FIGURE 1: Tank Combat in Progress

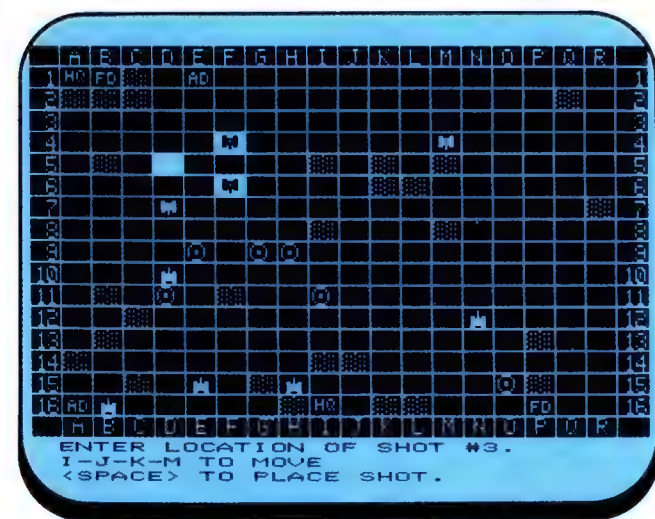


TABLE 1: Program Logic

Lines	Function
100	Loads the shape table and initializes the pointers
110-130	Initialization phase of game
170-240	Check the game grid to determine the number of shots and moves for the human player
250-290	Record the player's shot coordinates
300-500	Record the player's tank moves, check for mines, HQ, fuel depot or ammo dump and take appropriate action
510-520	Check for a winner
530-620	Check whether the computer's shots hit the player's tanks
630-670	Check tank positions and determine the outcome of tank-to-tank combat
680	Checks for a winner
690-780	Initiate the computer's move and check the number of shots and spaces allowed
790-850	Enter the computer's shot coordinates for use after the next player's tank move
860-930	Move the tanks on the computer's game grid
940	Checks for a winner
950-1040	Check whether the player's shots hit a computer tank and check for a winner
1060-1100	Check for tank-to-tank combat
1110	Checks for a winner
1120	Starts the next round
1130-1530	Tank-to-tank combat routine
1540-1650	Check for a winner or a tie game, and display the appropriate message
1660-1950	Select computer shots based on player's tank locations
1960-2770	Select computer tank moves based on location of human tanks, HQ, ammo dump and fuel depot
2780-3060	Initialization routine, which draws the game grid and places 14 barriers at random on both halves of the grid
3070-3310	Locate computer's game pieces on the grid
3320-3520	Locate player's game pieces on the grid
3530-3550	Pick random numbers
3560-3570	Draw and erase player's mines at beginning and end of player's turn
3580-3630	Display where shots land on game grid
3640	WAIT loop
3650	Centering routine for messages
3660-3690	POKE sound routine for messages
3700-4100	Input routine
4110-4120	Print I, J, K, M prompt

cal. Each tank may move up to three squares in a turn, or you can choose not to move it. Use the I, J, K, and M keys to position the tank and the space bar to complete the move. If the move is illegal because you have exceeded the three-square maximum or the total for that round, you will be given another chance to move that tank. It is also illegal to move a tank to a square occupied by your own tank or an anti-tank barrier. A tank may pass through or jump over tanks or barriers, but may not land on them.

Each player starts with 12 moves per round — two for each tank. When a tank is destroyed, the total is decreased by two moves. When a player's fuel depot is destroyed, then the total becomes one move per tank. When the HQ is destroyed, the number of moves otherwise allowed is cut in half.

Be careful of the enemy's hidden mines on the top half of the board. Also, be sure you don't move a tank onto a square where you have placed a shot.

Tank-to-Tank Combat

Another way to battle the opposition forces is to have a player's



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The user manual is easy to understand and is packed with money and time saving U-DO-IT information. The Disk Drive Analyzer section alone will pay for the package after just one use!

As quoted by the experts; Nibble magazine says, "This program should be in the library of every Apple user". Howard Sams Tech Manual, Softalk, InCider, Apple Orchard and Popular Computing have all awarded Master Diagnostics with triple AAA ratings. Consumers Guide chose Master Diagnostics as one of the best programs for 1984.

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tank land on a space adjacent to the enemy's tank (either horizontally or vertically). The survivor of the battle is the tank with the lower armor rating number. If the tanks have the same rating, both are destroyed. Since the armor ratings of the computer's tanks are never displayed, tank-to-tank combat is risky!

An average game lasts 10 to 15 minutes. But, to paraphrase an ad slogan, I'll bet you can't play just one game!

ENTERING THE PROGRAM

To key in the program, type in the Applesoft program shown in Listing 1 and save it before you run it with the command:

SAVE TANK.COMBAT

To enter TANK.SHAPES (Listing 2) first enter the Monitor by typing CALL -151 <RETURN>. Start entering the shape table at \$803. When all the code has been entered, save the shape table by typing:

BSAVE TANK.S, A\$803, L\$278

For more help with entering Nibble listings, see "A Welcome to New Nibble Readers" at the beginning of this issue.

HOW IT WORKS

TANK.COMBAT (Listing 1) relocates itself above Hi-Res page 1. A binary shape table file, TANK.SHAPES (Listing 2), resides where Applesoft programs are usually placed.

All of the major routines in TANK.COMBAT have REM statements, but Table 1 describes the program logic in greater detail.

Turtle BASIC, Nibble Calculator and Tank Combat are available on diskette for an introductory price of \$19.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: TANK.COMBAT

```

10 REM *****
20 REM "      TANK COMBAT      "
30 REM "      BY RUDY GUY      "
40 REM "      COPYRIGHT (C) 1986 "
50 REM "      BY MICROSPARC, INC "
60 REM "      CONCORD, MA 01742 "
70 REM *****
80 HOME : VTAB 12: HTAB 8: INVERSE PRINT "
  TANK COMBAT": NORMAL : PRINT " BY RUDY
  GUY": PRINT " ** COPYRIGHT 1986 BY MICRO
  PARC, INC *"
90 IF PEEK (104) < > 64 THEN POKE 104,64:
  POKE 103,1: POKE 16384,0: PRINT CHR$ (
  4)"RUN TANK.COMBAT"
100 PRINT CHR$ (4)"BLOAD TANK.SHAPES,A$803"
  : POKE 232,3: POKE 233,8: ROT= 0: SCALE=
  1
110 GOSUB 3660: REM INITIALIZE SOUND ROUTIN
  E
120 DIM A$(16,18): TEXT : HOME : VTAB 22: M$ =
  "TANK COMBAT BY RUDY GUY": GOSUB 3650: VTAB
  23: M$ = " * COPYRIGHT 1986 BY MICROSPARC,
  INC *": GOSUB 3650
130 GOSUB 2780: TU = 1: GOSUB 700
140 REM BEGIN GAME
150 MV = 0: FL = 0: HQ = 0: HS = 0: NU = 10: B$ =
  "C"
160 HOME : M$ = "DISPLAYING HUMAN'S MINES.": GOSUB
  3650
170 FOR I = 1 TO 16: FOR J = 1 TO 18
180 IF A$(I,J) = "M12" THEN XDRAW 19 AT J *
  14.Y + (I * 9)
190 IF A$(I,J) = "AD2" THEN HS = 6
200 IF A$(I,J) = "FD2" THEN FL = 1
210 IF A$(I,J) = "HQ2" THEN HQ = 1

```



```

220 IF RIGHT$(A$(I,J),1) = "H" THEN MV = M
    V + 1: IF HS < > 6 THEN HS = HS + 1
230 NEXT J,I: IF FL = 1 THEN MV = MV * 2: FL =
    0
240 IF NOT HQ THEN HS = INT (HS / 2): IF H
    S = 0 THEN HS = 1
250 FOR I = 1 TO HS
260 OB$ = "SHOT #" + STR$(I): GOSUB 4120: RS
    = 16: RE = 1: R = 1: C = 1: SH = 37: A$ = "K
    ": GOSUB 3710
270 HX(I) = R: HY(I) = C
280 NEXT
290 FOR I = 1 TO HS: XDRAW 37 AT HY(I) * 14,
    Y + (HX(I) * 9): NEXT
300 REM MOVE TANKS
310 FOR K = 1 TO 6: TX = 0: TY = 0
320 IF XH(K) > 0 THEN TX = XH(K): TY = YH(K)
330 IF TX = 0 THEN NEXT K
340 HOME: INVERSE: VTAB 24: PRINT "MOVES R
    EMAINING: "MV": NORMAL: VTAB 21: HTAB 1:
    PRINT "NEW LOCATION FOR TANK #"K: PRINT
    "USE I-J-K-M TO MOVE": PRINT "<SPACE> TO
    PLACE TANK":
350 FOR L = 1 TO 11: XDRAW 31 AT TY * 14, Y +
    (TX * 9): FOR D = 1 TO 50: NEXT D: L: SH =
    20 + K: XDRAW SH AT TY * 14, Y + (TX * 9)
360 R = TX: C = TY: RS = 16: RE = 1: MT = 1: A$ =
    "K": GOSUB 3710
370 IF R = TX AND C = TY THEN XDRAW SH AT T
    Y * 14, Y + (TX * 9): XDRAW 31 AT TY * 14
    , Y + (TX * 9): GOTO 480
380 MX = ABS (TX - R): MY = ABS (TY - C): M =
    MX + MY
390 IF M > 3 OR M > MV THEN PRINT: PRINT CHR$
    (7) "YOU CAN'T MOVE THAT FAR!": XDRAW SH AT
    YH(K) * 14, Y + (XH(K) * 9): XDRAW 31 AT
    YH(K) * 14, Y + (XH(K) * 9): GOSUB 3640: GOTO
    340
400 IF A$(R,C) = "HQ" THEN XDRAW 32 AT C *
    14, Y + (R * 9): A$(R,C) = ""
410 IF A$(R,C) = "AD" THEN XDRAW 33 AT C *
    14, Y + (R * 9): A$(R,C) = ""
420 IF A$(R,C) = "FD" THEN XDRAW 34 AT C *
    14, Y + (R * 9): A$(R,C) = ""
430 IF A$(R,C) = "" THEN A$(R,C) = STR$(K)
    + "H": XH(K) = R: YH(K) = C: A$(TX,TY) = ""
    : XDRAW SH AT TY * 14, Y + (TX * 9): XDRAW
    31 AT C * 14, Y + (R * 9): TX(K) = R: TY(K)
    = C: GOTO 460
440 IF LEFT$(A$(R,C),1) = "M" THEN XDRAW
    SH AT TY * 14, Y + (TX * 9): A$(R,C) = ""
    : FOR D = 1 TO 50: XDRAW 35 AT C * 14, Y +
    (R * 9): NEXT: HCOLOR = 3: DRAW 37 AT C *
    14, Y + R * 9: HCOLOR = 0: XH(K) = 0: YH(K) =
    0: A$(TX,TY) = "": HOME: PRINT CHR$(7)
    "TANK HIT MINE AND WAS DESTROYED!": GOSUB
    3640: GOTO 460
450 IF A$(R,C) < > "" THEN HOME: PRINT CHR$
    (7) "THAT SPACE IS OCCUPIED!": XDRAW SH AT
    YH(K) * 14, Y + XH(K) * 9: XDRAW 31 AT YH
    (K) * 14, Y + XH(K) * 9: GOSUB 3640: GOTO
    340
460 MV = MV - M: IF MV = 0 THEN K = 6
470 TX = 0: TY = 0
480 NEXT: HOME
490 FOR I = 9 TO 16: FOR J = 1 TO 18: IF A$(
    I,J) = "MI2" THEN XDRAW 19 AT J * 14, Y +
    (I * 9)
500 NEXT J,I
510 GOSUB 1540: REM CHECK FOR A WINNER
520 IF SC = 0 THEN NEXT 640
530 FOR I = 1 TO SC
540 IF A$(CX(I),CY(I)) = "" THEN PRINT "COM
    PUTER SHOT NUMBER "I" MISSED.": GOSUB 35
    80: GOTO 620
550 IF A$(CX(I),CY(I)) = "B" THEN HCOLOR = 3
    : DRAW 20 AT CY(I) * 14, Y + (CX(I) * 9):
    A$(CX(I),CY(I)) = "": PRINT "COMPUTER SH
    OT NUMBER "I" DESTROYED A BARRIER.":
    GOSUB 3580: GOTO 620
560 IF LEFT$(A$(CX(I),CY(I)),1) = "M" THEN
    GOSUB 3530: IF N / 2 = INT (N / 2) THEN
    PRINT "COMPUTER SHOT NUMBER "I" MISSED.
    ": GOSUB 3580: GOTO 620

```

continued on next page

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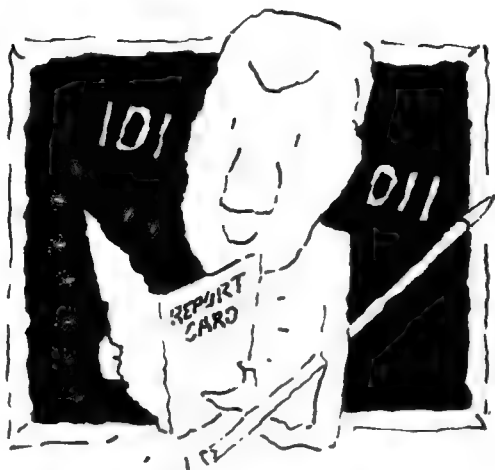
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LISTING 1: TANK.COMBAT (continued)

```

570 IF LEFT$(A$(CX(I),CY(I)),1) = "M" THEN
    A$(CX(I),CY(I)) = " ": PRINT "COMPUTER SH
    OT NUMBER "I" DESTROYED A MINE.": GOSUB
    3580: GOTO 620
580 IF RIGHT$(A$(CX(I),CY(I)),1) = "H" THEN
    XDRAW 31 AT CY(I) * 14,Y + (CX(I) * 9):
    PRINT "COMPUTER SHOT NUMBER "I" DESTROY
    ED A TANK." CHR$(7):NU = VAL (A$(CX(I
    ),CY(I)):TX(NU) = 0:TY(NU) = 0
590 IF RIGHT$(A$(CX(I),CY(I)),1) = "H" THEN
    GOSUB 3580: XH( VAL (A$(CX(I),CY(I))) ) =
    0: YH( VAL (A$(CX(I),CY(I))) ) = 0: A$(CX(I
    ),CY(I)) = " ": GOTO 620
600 IF RIGHT$(A$(CX(I),CY(I)),1) = "C" THEN
    XDRAW 36 AT CY(I) * 14,Y + (CX(I) * 9):
    XC( VAL (A$(CX(I),CY(I))) ) = 0: YC( VAL (
    A$(CX(I),CY(I))) ) = 0: PRINT "THE COMPUT
    ER SHOT ITS OWN TANK!" CHR$(7):A$(CX(I
    ),CY(I)) = " ": GOSUB 3580: GOTO 620
610 PRINT "COMPUTER SHOT NUMBER "I" MISSED."
    : GOSUB 3580
620 FOR D = 1 TO 3000: NEXT : GOSUB 1540: NEXT

630 HOME :A = 31:B = 36
640 FOR K = 1 TO 6
650 IF TX(K) = 0 THEN 670
660 GOSUB 1130: REM CHECK FOR TANK TO TANK
    COMBAT
670 TX(K) = 0:TY(K) = 0: NEXT K
680 GOSUB 1540: REM CHECK FOR A WINNER
690 REM COMPUTER MOVE
700 HOME :M$ = "COMPUTER PLACING ITS SHOTS."
    : GOSUB 3650
710 MV = 0:FL = 0:HQ = 0:SC = 0:B$ = "H"
720 FOR I = 1 TO 16: FOR J = 1 TO 18
730 IF A$(I,J) = "AD" THEN SC = 6
740 IF A$(I,J) = "FD" THEN FL = 1
750 IF A$(I,J) = "HQ" THEN HQ = 1
760 IF RIGHT$(A$(I,J),1) = "C" THEN MV = M
    V + 1: IF SC < > 6 THEN SC = SC + 1
770 NEXT J,I: IF FL = 1 THEN MV = MV * 2: FL =
    0
780 IF NOT HQ THEN SC = INT (SC / 2): IF S
    C = 0 THEN SC = 1
790 REM PICK COMPUTER SHOTS
800 S = 0
810 FOR K = 6 TO 1 STEP - 1
820 IF XH(K) > 0 THEN I = XH(K):J = YH(K):S =
    S + 1: GOSUB 1660: IF S = SC THEN K = 1
830 NEXT
840 IF S < SC THEN 810
850 IF TU THEN TU = 0: RETURN
860 HOME :M$ = "COMPUTER'S TURN TO MOVE TANK
    S.": GOSUB 3650
870 NU = 4: GOSUB 3530: IF N / 2 = INT (N /
    2) THEN W = 1: FOR K = 6 TO 1 STEP - 1:
    TX = 0:TY = 0: GOTO 890
880 FOR K = 1 TO 6:TX = 0:TY = 0
890 IF XC(K) > 0 THEN I = XC(K):J = YC(K): GOSUB
    1960: MV = MV - S
900 IF W AND MV < = 0 THEN K = 1
910 IF NOT W AND MV < = 0 THEN K = 6
920 REM
930 NEXT K:W = 0
940 GOSUB 1540: REM CHECK FOR WINNER
950 HOME : FOR I = 1 TO HS
960 IF A$(HX(I),HY(I)) = " " THEN PRINT "HUM
    AN'S SHOT NUMBER "I" MISSED.": GOSUB 361
    0: GOTO 1040
970 IF A$(HX(I),HY(I)) = "B" THEN HCOLOR= 3
    : DRAW 20 AT HY(I) * 14,Y + (HX(I) * 9):
    A$(HX(I),HY(I)) = " ": PRINT "HUMAN'S SHO
    T NUMBER "I" DESTROYED A": PRINT "BARRIE
    R.": GOSUB 3610: GOTO 1040
980 IF LEFT$(A$(HX(I),HY(I)),1) = "M" THEN
    GOSUB 3530: IF N / 2 = INT (N / 2) THEN
    PRINT "HUMAN'S SHOT NUMBER "I" MISSED."
    : GOSUB 3610: GOTO 1040
990 IF LEFT$(A$(HX(I),HY(I)),1) = "M" THEN
    A$(HX(I),HY(I)) = " ": PRINT "HUMAN'S SHO
    T NUMBER "I" DESTROYED A MINE.": GOSUB 3
    610: GOTO 1040

```



```

1000 IF RIGHT$ (A$(HX(I),HY(I)),1) = "C" THEN
  XDRAW 36 AT HY(I) * 14,Y + (HX(I) * 9):
  PRINT "HUMAN'S SHOT NUMBER "I" DESTROYE
  D A TANK." CHR$ (7):NU = VAL (A$(HX(I),
  HY(I)):TX(NU) = 0:TY(NU) = 0
1010 IF RIGHT$ (A$(HX(I),HY(I)),1) = "C" THEN
  GOSUB 3610:XC(NU) = 0:YC(NU) = 0:A$(HX(
  I),HY(I)) = "": GOTO 1040
1020 IF RIGHT$ (A$(HX(I),HY(I)),1) = "H" THEN
  XDRAW 31 AT HY(I) * 14,Y + (HX(I) * 9):
  XH( VAL (A$(HX(I),HY(I))) = 0:YH( VAL (
  A$(HX(I),HY(I))) = 0: PRINT "THE HUMAN
  SHOT ITS OWN TANK!" CHR$ (7):A$(HX(I),HY
  (I)) = "": GOSUB 3610: GOTO 1040
1030 PRINT "HUMAN'S SHOT NUMBER "I" MISSED."
  : GOSUB 3610
1040 GOSUB 3640:HX(I) = 0:HY(I) = 0: GOSUB 1
  540: NEXT
1050 HOME
1060 FOR K = 1 TO 6
1070 IF TX(K) = 0 THEN 1100
1080 A = 36:B = 31
1090 GOSUB 1130: REM CHECK FOR TANK TO TANK
  COMBAT
1100 TX(K) = 0:TY(K) = 0: NEXT K
1110 GOSUB 1540: REM CHECK FOR A WINNER
1120 HOME : GOTO 150
1130 REM ROUTINE TO CHECK FOR TANK TO TANK
  COMBAT
1140 D = 1
1150 ON D GOSUB 1180,1240,1300,1360
1160 D = D + 1: IF D = 5 THEN D = 1: RETURN
1170 GOTO 1150
1180 R = TX(K) - 1:C = TY(K): IF R = < 1 THEN
  RETURN
1190 IF RIGHT$ (A$(R,C),1) = B$ THEN 1210
1200 RETURN
1210 GOSUB 1420
1220 IF NOT FL THEN RETURN
1230 FL = 0:D = 4: RETURN
1240 R = TX(K) + 1:C = TY(K): IF R > 16 THEN
  RETURN
1250 IF RIGHT$ (A$(R,C),1) = B$ THEN 1270
1260 RETURN
1270 GOSUB 1420
1280 IF NOT FL THEN RETURN
1290 FL = 0:D = 4: RETURN
1300 R = TX(K):C = TY(K) - 1: IF C < 1 THEN RETURN
1310 IF RIGHT$ (A$(R,C),1) = B$ THEN 1330
1320 RETURN
1330 GOSUB 1420
1340 IF NOT FL THEN RETURN
1350 FL = 0:D = 4: RETURN
1360 R = TX(K):C = TY(K) + 1: IF C > 18 THEN
  RETURN
1370 IF RIGHT$ (A$(R,C),1) = B$ THEN 1390
1380 RETURN
1390 GOSUB 1420
1400 IF NOT FL THEN RETURN
1410 FL = 0:D = 4: RETURN
1420 REM COMBAT
1430 FOR I = 1 TO 5: PRINT CHR$ (7): NEXT :
  HOME : HTAB 17: FLASH : PRINT "COMBAT":
  NORMAL : FOR I = 1 TO 3000: NEXT
1440 FOR I = 1 TO 10: XDRAW A AT TY(K) * 14,
  Y + (TX(K) * 9): XDRAW B AT C * 14,Y + (
  R * 9): FOR J = 1 TO 50: NEXT : NEXT
1450 IF K = VAL ( LEFT$ (A$(R,C),1)) THEN XDRAW
  A AT TY(K) * 14,Y + (TX(K) * 9): XDRAW B
  AT C * 14,Y + (R * 9):FL = 1: HOME : PRINT
  "BOTH TANKS DESTROYED.":A$(R,C) = "":A$(
  TX(K),TY(K)) = "":XC(K) = 0:YC(K) = 0:XH
  (K) = 0:YH(K) = 0: GOTO 1530
1460 IF B$ = "C" THEN 1490
1470 IF K < VAL ( LEFT$ (A$(R,C),1)) THEN XDRAW
  36 AT TY(K) * 14,Y + (TX(K) * 9):A$(TX(K)
  ),TY(K)) = "":XC(K) = 0:YC(K) = 0: HOME
  : PRINT "COMPUTER TANK DESTROYED!": GOTO
  1530
1480 GOTO 1520
1490 IF K > VAL ( LEFT$ (A$(R,C),1)) THEN XDRAW
  36 AT C * 14,Y + (R * 9):XC( VAL (A$(R,C)
  ))) = 0:YC( VAL (A$(R,C))) = 0:A$(R,C) =
  "": HOME : PRINT "COMPUTER TANK DESTROYE
  D!": GOTO 1530

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continued on page 65



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LISTING 1: TANK.COMBAT (continued)

```

1500 XDRAW 31 AT TY(K) * 14,Y + (TX(K) * 9):
    FL = 1: HOME : PRINT "HUMAN'S TANK DESTROYED!":XH( VAL (AS(TX(K),TY(K))) = 0:YH( VAL (AS(TX(K),TY(K))) = 0:AS(TX(K),TY(K)) = ""
1510 GOTO 1530
1520 XDRAW 31 AT C * 14,Y + (R * 9):FL = 1: HOME : PRINT "HUMAN'S TANK DESTROYED!":XH( VAL (AS(R,C))) = 0:YH( VAL (AS(R,C))) = 0:AS(R,C) = ""
1530 FOR I = 1 TO 4000: NEXT : RETURN
1540 REM LOOK FOR A WINNER
1550 H = 0:C = 0
1560 FOR WI = 1 TO 6
1570 IF XC(WI) > 0 THEN C = C + 1
1580 IF XH(WI) > 0 THEN H = H + 1
1590 NEXT
1600 IF H = 0 AND C = 0 THEN FOR I = 1 TO 5 : PRINT CHR$(7): NEXT : PRINT "THIS MATCH HAS ENDED IN A TIE. WOULD YOU LIKE TO TRY AGAIN?": GOTO 1640
1610 IF H = 0 THEN FOR I = 1 TO 5: PRINT CHR$(7): NEXT : HOME : PRINT "SORRY HUMAN, I WON THIS ROUND. WOULD YOU LIKE TO TRY AGAIN?": GOTO 1640
1620 IF C = 0 THEN FOR I = 1 TO 5: PRINT CHR$(7): NEXT : HOME : PRINT "CONGRATULATION S, YOU WON THIS ROUND. WOULD YOU LIKE TO TRY AGAIN?": GOTO 1640
1630 RETURN : REM STILL TANKS LEFT
1640 INPUT "":AS: IF LEFT$(AS,1) = "N" THEN TEXT : HOME : END
1650 CLEAR : GOTO 120
1660 REM SELECT COMPUTER SHOT LOCATION
1670 NU = 10: GOSUB 3530
1680 IF N / 2 = INT (N / 2) THEN D = 4: GOTO 1710
1690 IF N = 1 OR N = 3 OR N = 9 THEN NU = 2: GOSUB 3530:D = 1 + N: GOTO 1710
1700 IF N = 5 OR N = 7 OR N = 10 THEN D = 1
1710 NU = 3: GOSUB 3530: IF N = 3 THEN NU = 2: GOSUB 3530: ON D GOSUB 1860,1910,1910,1860: IF DI THEN DI = 0:NU = 2: GOTO 1730
1720 NU = 3
1730 GOSUB 3530: ON D GOTO 1740,1770,1800,1830
1740 IF I + N > 16 THEN 1670
1750 IF RIGHT$(AS(I + N,J),1) < > "1" AND RIGHT$(AS(I + N,J),1) < > "C" THEN CX(S) = I + N:CY(S) = J: RETURN
1760 GOTO 1670
1770 IF J - N < 1 THEN 1670
1780 IF RIGHT$(AS(I,J - N),1) < > "1" AND RIGHT$(AS(I,J - N),1) < > "C" THEN CX(S) = I:CY(S) = J - N: RETURN
1790 GOTO 1670
1800 IF J + N > 18 THEN 1670
1810 IF RIGHT$(AS(I,J + N),1) < > "1" AND RIGHT$(AS(I,J + N),1) < > "C" THEN CX(S) = I:CY(S) = J + N: RETURN
1820 GOTO 1670
1830 IF I - N < 1 THEN 1670
1840 IF RIGHT$(AS(I - N,J),1) < > "1" AND RIGHT$(AS(I - N,J),1) < > "C" THEN CX(S) = I - N:CY(S) = J: RETURN
1850 GOTO 1670
1860 IF N = 1 THEN 1890
1870 IF J - 1 < 1 THEN RETURN
1880 J = J - 1:DI = 1: RETURN
1890 IF J + 1 > 18 THEN RETURN
1900 J = J + 1:DI = 1: RETURN
1910 IF N = 1 THEN 1940
1920 IF I - 1 < 1 THEN RETURN
1930 I = I - 1:DI = 1: RETURN
1940 IF I + 1 > 16 THEN RETURN
1950 I = I + 1:DI = 1: RETURN
1960 REM MOVE COMPUTER TANK
1970 TX = I:TY = J:FL = 0:TI = 0:S = 0
1980 FOR D = 1 TO 16
1990 IF RIGHT$(AS(D,J),1) = "H" OR AS(D,J) = "HQ2" OR AS(D,J) = "AD2" OR AS(D,J) = "FD2" THEN FL = D
2000 NEXT D: IF FL < > 0 THEN GOTO 2400
2010 FOR D = 1 TO 18
2020 IF RIGHT$(AS(I,D),1) = "H" OR AS(I,D)

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```

= "HQ2" OR AS(I,D) = "AD2" OR AS(I,D) = "FD2" THEN FL = D
2030 NEXT D: IF FL < > 0 THEN GOTO 2420
2040 NU = 4: GOSUB 3530:TI = TI + 1: IF TI > 10 THEN RETURN
2050 FL = 0: ON N GOTO 2120,2190,2260,2330
2060 IF AS(TR,TC) = "HQ2" THEN XDRAW 32 AT TC * 14,Y + (TR * 9):AS(TR,TC) = ""
2070 IF AS(TR,TC) = "AD2" THEN XDRAW 33 AT TC * 14,Y + (TR * 9):AS(TR,TC) = ""
2080 IF AS(TR,TC) = "FD2" THEN XDRAW 34 AT TC * 14,Y + (TR * 9):AS(TR,TC) = ""
2090 IF AS(TR,TC) = "" THEN XDRAW 36 AT TY * 14,Y + (TX * 9):AS(TR,TC) = AS(I,J):XC(K) = TR:YC(K) = TC:AS(I,J) = "": XDRAW 36 AT TC * 14,Y + (TR * 9):TX(K) = TR:TY(K) = TC: GOTO 2440
2100 IF AS(TR,TC) = "MI2" THEN XDRAW 36 AT TY * 14,Y + (TX * 9): FOR D = 1 TO 50: XDRAW 35 AT TC * 14,Y + (TR * 9): NEXT :AS(TR,TC) = "":XC(K) = 0:YC(K) = 0:AS(TX,TY) = "": HOME : PRINT CHR$(7)"TANK HIT MINE AND WAS DESTROYED!": GOSUB 3640:S = N: RETURN
2110 RETURN
2120 REM MOVE UP
2130 IF I = 1 THEN 2040
2140 NU = 3: GOSUB 3530: IF I - N < 1 THEN 2040
2150 IF MV < = 0 THEN RETURN
2160 IF MV - N < 0 THEN 2140
2170 TR = I - N:TC = J:D = 1
2180 GOTO 2060
2190 REM MOVE DOWN
2200 IF I = 16 THEN 2040
2210 NU = 3: GOSUB 3530: IF I + N > 16 THEN 2040
2220 IF MV < = 0 THEN RETURN
2230 IF MV - N < 0 THEN 2210
2240 TR = I + N:TC = J:D = 2
2250 GOTO 2060
2260 REM MOVE LEFT
2270 IF J = 1 THEN 2040
2280 NU = 3: GOSUB 3530: IF J - N < 1 THEN 2040
2290 IF MV < = 0 THEN RETURN
2300 IF MV - N < 0 THEN 2280
2310 TR = I:TC = J - N:D = 3
2320 GOTO 2060
2330 REM MOVE RIGHT
2340 IF J = 18 THEN 2040
2350 NU = 3: GOSUB 3530: IF J + N > 18 THEN 2040
2360 IF MV < = 0 THEN RETURN
2370 IF MV - N < 0 THEN 2350
2380 TR = I:TC = J + N:D = 4
2390 GOTO 2060
2400 IF FL < I THEN N = 1:D = 1: GOTO 2050
2410 N = 2:D = 2: GOTO 2050
2420 IF FL < J THEN N = 3:D = 3: GOTO 2050
2430 N = 4:D = 4: GOTO 2050
2440 S = N: IF N < 3 AND MV - S > 0 THEN 2460
2450 RETURN
2460 NU = 2: GOSUB 3530
2470 I = TX(K):J = TY(K):TX = I:TY = J:XC = I:YC = J
2480 IF D < = 2 THEN ON N GOSUB 2600,2650: RETURN
2490 IF D > 2 THEN ON N GOSUB 2500,2550: RETURN
2500 IF I = 1 THEN RETURN
2510 GOSUB 2770: IF N = 0 THEN RETURN
2520 IF MV - (S + N) < 0 THEN RETURN
2530 IF I - N < 1 THEN RETURN
2540 TR = I - N:TC = J: GOTO 2700
2550 IF I = 16 THEN RETURN
2560 GOSUB 2770: IF N = 0 THEN RETURN
2570 IF MV - (S + N) < 0 THEN RETURN
2580 IF I + N > 16 THEN RETURN
2590 TR = I + N:TC = J: GOTO 2700
2600 IF J = 1 THEN RETURN
2610 GOSUB 2770: IF N = 0 THEN RETURN
2620 IF MV - (S + N) < 0 THEN RETURN
2630 IF J - N < 1 THEN RETURN
2640 TR = I:TC = J - N: GOTO 2700
2650 IF J = 18 THEN RETURN
2660 GOSUB 2770: IF N = 0 THEN RETURN
2670 IF MV - (S + N) < 0 THEN RETURN

```

continued on page 67

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LISTING 1: TANK.COMBAT (continued)

```

2680 IF J + N > 18 THEN RETURN
2690 TR = I:TC = J + N
2700 FL = 0
2710 IF A$(TR,TC) = "HQ2" THEN XDRAW 32 AT
    TC * 14,Y + (TR * 9):A$(TR,TC) = ""
2720 IF A$(TR,TC) = "AD2" THEN XDRAW 33 AT
    TC * 14,Y + (TR * 9):A$(TR,TC) = ""
2730 IF A$(TR,TC) = "FD2" THEN XDRAW 34 AT
    TC * 14,Y + (TR * 9):A$(TR,TC) = ""
2740 IF A$(TR,TC) = "" THEN XDRAW 36 AT TY *
    14,Y + (TX * 9):A$(TR,TC) = A$(I,J):A$(I,
    J) = "":XDRAW 36 AT TC * 14,Y + (TR *
    9):TX(K) = TR:TY(K) = TC:XC(K) = TR:YC(K)
    ) = TC:S = S + N: RETURN
2750 IF A$(TR,TC) = "MI2" THEN XDRAW 36 AT
    TY * 14,Y + (TX * 9): FOR D = 1 TO 30: XDRAW
    35 AT TC * 14,Y + (TR * 9): NEXT :A$(TR,
    TC) = "":A$(TX,TY) = "":XC(K) = 0:YC(K) =
    0: HOME : PRINT CHR$(7)"TANK HIT MINE
    AND WAS DESTROYED!": GOSUB 3640:S = S +
    N: RETURN
2760 RETURN
2770 NU = 3 - S: GOSUB 3530: RETURN
2780 REM DRAW GRID
2790 HGR : HCOLOR= 3: HPLLOT 0,0: CALL - 308
    2
2800 HCOLOR= 0: FOR I = 8 TO 161 STEP 9: HPLLOT
    0,I TO 279,I: NEXT
2810 J = 1
2820 FOR I = 13 TO 265 STEP 14: HPLLOT I,0 TO
    I,161
2830 IF J = 19 THEN 2850
2840 DRAW J AT I + 4,7: DRAW J AT I + 4,159:
    J = J + 1
2850 NEXT
2860 J = 1
2870 FOR I = 16 TO 159 STEP 9
2880 A$ = STR$(J)
2890 IF LEN (A$) < 2 THEN A$ = " " + A$
2900 IF LEFT$(A$,1) = " " THEN 2920
2910 DRAW ( VAL ( LEFT$(A$,1))) + 20 AT 1,I
    : DRAW ( VAL ( LEFT$(A$,1))) + 20 AT 26
    8,I
2920 S = VAL ( RIGHT$(A$,1)):S = S + 20: IF
    S = 20 THEN S = 30
2930 DRAW S AT 6,I: DRAW S AT 273,I
2940 J = J + 1: NEXT
2950 Y = 7:J = 1: HCOLOR= 1
2960 FOR I = 1 TO 8: FOR K = 1 TO 18
2970 NU = 10: GOSUB 3530: IF N = 2 THEN A$(I,
    K) = "B": DRAW 20 AT K * 14,Y + (I * 9):
    J = J + 1
2980 IF J = 15 THEN K = 18:I = 8
2990 NEXT K,I
3000 IF J < 15 THEN 2960
3010 J = 1
3020 FOR I = 16 TO 10 STEP - 1: FOR K = 1 TO
    18
3030 GOSUB 3530: IF N = 2 THEN A$(I,K) = "B"
    : DRAW 20 AT K * 14,Y + (I * 9):J = J +
    1
3040 IF J = 15 THEN K = 18:I = 10
3050 NEXT K,I
3060 IF J < 15 THEN 3020
3070 REM COMPUTER LOCATIONS
3080 FOR I = 1 TO 8: FOR J = 1 TO 18
3090 GOSUB 3530: IF N = 3 AND A$(I,J) = "" THEN
    A$(I,J) = "HQ": XDRAW 32 AT J * 14,Y + (
    I * 9):I = 8:J = 18:FL = 1
3100 NEXT J,I
3110 IF NOT FL THEN 3080
3120 FL = 0
3130 FOR I = 1 TO 8: FOR J = 1 TO 18
3140 GOSUB 3530
3150 IF N = 3 AND A$(I,J) = "" THEN A$(I,J) =
    "AD": XDRAW 33 AT J * 14,Y + (I * 9):I =
    8:J = 18:FL = 1
3160 NEXT J,I: IF NOT FL THEN 3130
3170 FL = 0
3180 FOR I = 1 TO 8: FOR J = 1 TO 18
3190 GOSUB 3530: IF N = 3 AND A$(I,J) = "" THEN
    A$(I,J) = "FD": XDRAW 34 AT J * 14,Y + (
    I * 9):I = 8:J = 18:FL = 1
3200 NEXT J,I: IF NOT FL THEN 3180
3210 FL = 0

```

continued on next page

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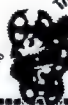
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```

3760 IF A$(R,C) = "B" OR A$(R,C) = "HQ2" OR
A$(R,C) = "AD2" OR A$(R,C) = "FD2" THEN
3850
3770 IF FL THEN FL = 0: GOTO 3760
3780 IF MT THEN GOTO 3800
3790 XDRAW SH AT C * 14,Y + (R * 9): IF R =
TX AND C = TY AND SH > 20 AND SH < 27 THEN
XDRAW SH AT C * 14,Y + R * 9: MT = 1
3800 POKE 49168,0: WAIT - 16384,128: A$ = CHR$
( PEEK ( - 16384) - 128): POKE 49168,0
3810 IF MT THEN IF A$ < > "I" AND A$ < >
"J" AND A$ < > "K" AND A$ < > "M" AND
A$ < > CHR$ (32) THEN 3710
3820 IF MT THEN MT = 0: GOTO 3840
3830 XDRAW SH AT C * 14,Y + (R * 9): IF A$ <
> "I" AND A$ < > "J" AND A$ < > "K" AND
A$ < > "M" AND A$ < > CHR$ (32) THEN
3710
3840 IF A$ = CHR$ (32) THEN 4010
3850 IF A$ = "I" THEN 3900
3860 IF A$ = "J" THEN 3930
3870 IF A$ = "K" THEN 3960
3880 IF A$ = "M" THEN 3990
3890 REM MOVE UP
3900 IF R = RE THEN R = RS: GOTO 3710
3910 R = R - 1: GOTO 3710
3920 REM MOVE LEFT
3930 IF C = 1 THEN C = 18: GOTO 3710
3940 C = C - 1: GOTO 3710
3950 REM MOVE RIGHT
3960 IF C = 18 THEN C = 1: GOTO 3710
3970 C = C + 1: GOTO 3710
3980 REM MOVE DOWN
3990 IF R = RS THEN R = RE: GOTO 3710
4000 R = R + 1: GOTO 3710
4010 IF SH = 37 OR SH > 20 AND SH < 27 THEN
4030
4020 IF A$(R,C) < > " " THEN HOME: PRINT CHR$
(7)"THAT SPACE IS OCCUPIED!": FOR D = 1 TO
2000: NEXT: GOSUB 4120: GOTO 3710
4030 IF SH > 20 AND SH < 27 THEN RETURN
4040 XDRAW SH AT C * 14,Y + (R * 9): RETURN

4050 IF I = 1 THEN RETURN
4060 FOR J = 1 TO I
4070 IF R = HX(J) AND C = HY(J) THEN FL = 1
4080 NEXT J
4090 IF FL THEN POP: FL = 0: GOTO 3850
4100 RETURN
4110 REM PRINT I-J-K-M PROMPT
4120 HOME: PRINT "ENTER LOCATION OF ";OB$: PRINT
"USE I-J-K-M TO MOVE": PRINT "<SPACE> TO
PLACE ";OB$;: RETURN

```

END OF LISTING 1

KEY PERFECT 5.0
RUN ON
TANK.COMBAT

CODE-5.0	LINE# - LINE#	CODE-4.0
3C9E4505	10 - 100	ADD6
E182930D	110 - 200	A60A
13834C6F	210 - 300	83BD
98963C43	310 - 400	F91A
1727D034	410 - 500	0113FB
16609335	510 - 600	01A186
D3D054F0	610 - 700	7761
8A19BD64	710 - 800	756A
9A8B880F	810 - 900	82A8
21461CCB	910 - 1000	012250
956D3F14	1010 - 1100	C352
A2C15017	1110 - 1200	4D33
44490541	1210 - 1300	43D8
13200042	1310 - 1400	3951
33F24B56	1410 - 1500	014F4A
55173D67	1510 - 1600	8CE3
34660436	1610 - 1700	ACD4
E360AEFC	1710 - 1800	88D1
1BF5CC71	1810 - 1900	67A6
D1CFFD9E	1910 - 2000	5E94
4D166CAB	2010 - 2100	0121AD
CC34D15C	2110 - 2200	3C16
E2742FF9	2210 - 2300	4674
6C8CBE76	2310 - 2400	44EB

continued on next page

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D0610171	2410	-	2500	5DBD
3A5452C2	2510	-	2600	438C
B1B92ACD	2610	-	2700	3CB1
7F6DAF08	2710	-	2800	0106B7
4C7746BE	2810	-	2900	4226
8B0A8378	2910	-	3000	6CB2
34B59D85	3010	-	3100	68C0
BE57EEB6	3110	-	3200	6FAC
DFA6FFA7	3210	-	3300	7EE9
DDFD4A61	3310	-	3400	843B
D3B34746	3410	-	3500	867F
5DA58092	3510	-	3600	6236
20B76DF7	3610	-	3700	7C45
4ED49F74	3710	-	3800	A947
4B1320DA	3810	-	3900	718D
B807BE46	3910	-	4000	46F9
F5D65C42	4010	-	4100	6126
DE00B952	4110	-	4120	294E
239F7EA2	= PROGRAM TOTAL =			3184

LISTING 2: TANK.SHAPE

0803-	25	00	4C	00	58
0808-	00	66	00	72	00 7E 00 8B
0810-	00	95	00	A2	00 AF 00 B8
0818-	00	C1	00	CE	00 D6 00 E3
0820-	00	EF	00	FB	00 05 01 12
0828-	01	1F	01	32	01 54 01 5C
0830-	01	68	01	75	01 81 01 8E
0838-	01	9C	01	A5	01 B3 01 C0
0840-	01	CF	01	E3	01 F5 01 06
0848-	02	16	02	E2	02 43 02 21
0850-	24	64	0C	15	15 3E 3F 4E
0858-	31	26	00	21	24 24 2C 2D

0860-	15	F6	3F	4E	31	1E	3F	04
0868-	00	09	2D	05	F8	1B	2D	24
0870-	0C	2D	15	04	00	29	2D	05
0878-	20	24	E4	3F	37	36	36	04
0880-	00	29	2D	E5	DB	24	2D	E5
0888-	1B	24	2D	2D	04	00	21	24
0890-	24	2C	2D	B5	1A	3F	04	00
0898-	09	2D	05	20	3C	BF	1A	24
08A0-	24	0C	2D	25	00	21	24	24
08A8-	AC	12	2D	04	40	36	36	36
08B0-	04	00	09	2D	1C	24	24	07
08B8-	28	25	00	01	A8	2D	20	24
08C0-	3C	28	25	00	21	24	24	6C
08C8-	09	1E	1E	1E	0E	0E	0E	04
08D0-	00	29	2D	E5	DB	24	24	24
08D8-	00	21	24	24	AC	0E	2E	80
08E0-	60	36	36	36	04	00	21	24
08E8-	24	AC	72	0E	56	24	24	24
08F0-	04	00	09	2D	05	20	24	E4
08F8-	3F	17	36	36	04	00	21	24
0900-	24	2C	2D	15	F6	3F	04	00
0908-	01	20	24	64	2D	15	36	B6
0910-	07	E0	16	27	00	21	24	24
0918-	2C	2D	15	F6	3F	0E	15	15
0920-	04	00	49	2D	2D	28	20	24
0928-	07	38	38	3F	17	17	36	76
0930-	05	40	25	27	00	29	0D	6D
0938-	6D	E5	FB	FB	FB	63	6D	6D
0940-	6D	E5	FB	FB	FB	63	6D	6D
0948-	6D	E5	FB	FB	FB	63	6D	6D
0950-	6D	E5	FB	FB	FB	23	00	09
0958-	2D	1C	24	24	BC	04	00	29
0960-	2D	E5	DB	64	2D	05	20	1C
0968-	3F	27	00	08	15	2D	05	20

0970-	1C	67	21	1C	3F	17	04	00
0978-	49	21	05	38	3F	27	0C	0C
0980-	0C	36	26	00	08	15	2D	05
0988-	20	1C	3F	27	24	2D	2D	04
0990-	00	09	2D	05	20	1C	3F	D6
0998-	24	24	0C	2D	15	04	00	09
09A0-	24	0C	0C	0C	3C	3F	27	00
09A8-	09	2D	05	20	1C	0C	E4	3F
09B0-	17	6E	3A	17	26	00	08	0E
09B8-	2D	05	20	24	E4	3F	17	76
09C0-	2D	04	00	09	2D	05	20	24
09C8-	E4	3F	17	36	36	2D	2D	64
09D0-	04	00	49	24	24	35	36	6E
09D8-	09	25	24	3C	36	3E	3F	2C
09E0-	25	3F	0C	24	04	00	09	80
09E8-	20	24	AC	2A	44	36	36	0D
09F0-	20	64	AD	B6	1F	0C	04	00
09F8-	09	20	24	0C	AD	9F	2D	36
0A00-	0D	24	24	2D	15	36	1E	27
0A08-	00	09	20	24	2C	2D	DE	2A
0A10-	4D	24	2D	15	36	1E	3F	24
0A18-	00	69	09	4D	E1	DF	DF	0C
0A20-	0D	0D	1C	3F	2C	2D	DF	1F
0A28-	07	68	69	29	F8	1B	DF	23
0A30-	00	49	49	20	05	38	27	0D
0A38-	3C	3F	36	3E	24	24	6D	09
0A40-	35	36	3E	24	24	00	24	24
0A48-	24	2C	2D	2D	2D	2D	2D	35
0A50-	36	36	36	3F	3F	3F	3F	3F
0A58-	27	24	24	2C	2D	2D	2D	2D
0A60-	35	36	36	3F	3F	3F	3F	27
0A68-	24	2C	2D	2D	2D	35	36	3F
0A70-	3F	3F	27	2C	2D	2D	35	3F
0A78-	3F	27	00					

END OF LISTING 2



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PROCURSOR

TIPS 'N TECHNIQUES

by Jim Lazar

If you're

yearning for the old solid box cursor on your //e or //c, now you can have it with this ProDOS routine. You can even choose a cursor character of your own.

Return with us now to the days of the blinking box cursor. When I bought my Apple //e, I was disappointed by the lack of the old, solid, blinking box cursor. By the time I upgraded to ProDOS, I was starved for the friendly, blinking box. To finally rid myself of the checkerboard cursor and the 80-column non-blinking cursor, I wrote ProCursor.

ProCursor replaces your system's cursor with the solid, blinking cursor that any veteran user of the Apple II or II Plus will recognize. ProCursor features include speedy movement on the 80-column screen, and the ability to convert the cursor to any character you want (such as an underline or even an apple-shaped character on the Apple //c).

ProCursor works on any Apple //c or //e under ProDOS with BASIC.SYSTEM installed. It operates exactly as the normal cursor does and is compatible with all Applesoft programs and any machine language programs that use the Monitor's KEYIN routine.

USING PROCURSOR

To install ProCursor, either execute the machine language program (Listing 1)

directly or run the Applesoft program (Listing 2). There are three ways to execute the machine language program directly:

BRUN PROCURSOR

or:

-PROCURSOR

or, from within a program:

PRINT CHR\$(4)“-PROCURSOR”

To run the Applesoft program (Listing 2), type:

RUN PROCURSOR.INST

The program automatically determines what type of //e or //c you have, and then offers you a choice of two cursor characters:

1. Solid Blinking Box
2. Custom Character

If you choose option 2, you are first asked for the code of your custom character. Consult Table 1 for some commonly used character codes.

Once the program is installed, it should

TABLE 1: Blink Character Values

Hex	Decimal	Blink Character
\$FF	255	Normal checkerboard
\$DF/\$9F	223/159	Normal underline
\$DE/\$9E	222/158	Normal caret (^)
\$AA	170	Normal asterisk (*)
\$A0	160	Normal space
\$7F	127	Inverse checkerboard
\$2B	43	Inverse plus sign (+)
\$20	32	Inverse space
\$1E	30	Inverse caret (^)

Apple //c and Enhanced Apple //e Only

\$40	64	Solid apple
\$41	65	Open apple
\$42	66	Pointer
\$5B	91	Diamond
\$5D	93	Cross

by Jim Lazar, 1109 Niesen Rd., Port Washington, WI 53074. ProCursor is compatible with ProDOS only.

MANAGING YOUR CHECKBOOK?
 MANAGING YOUR BUDGET?
 MANAGING YOUR BILLS?
 MANAGING YOUR CASH FLOW?
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 MANAGING YOUR CHARGE ACCOUNTS?
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LISTING 1: PROCURSOR

```

0000:      1  * *****
0000:      2  *   PROCURSOR
0000:      3  *   BY JIM LAZAR
0000:      4  *   COPYRIGHT (C) 1986
0000:      5  *   BY MICROSPARC, INC
0000:      6  *   CONCORD, MA 01742
0000:      7  * *****
0000:      8  *
0000:      9  *   Tool Kit Assembler
0000:     10  *
0000:     11  *   Equates
0000:     12  *

0000:     15  * *****
0000:     16  *   Zero Page
0000:     17  * *****
0000:     18  HCUR      EQU   $24
0000:     19  BAS      EQU   $28
0000:     20  RNDL     EQU   $4E
0000:     21  RNDH     EQU   $4F
0000:     22  WAITLEN  EQU   $FB
0000:     23  CHAR     EQU   $FC
0000:     24  OLDCHAR  EQU   $FD
0000:     25  SPECIAL  EQU   $FE
0000:     26  BNKCHAR  EQU   $FF
0000:     27  * *****
0000:     28  *   80-Column Card
0000:     29  * *****
0000:     30  HCUR80    EQU   $57B
0000:     31  * *****
0000:     32  *   Basic System
0000:     33  * *****
0000:     34  DOSIN     EQU   $BE36
0000:     35  IFILACTV  EQU   $BE44
0000:     36  EXACTV    EQU   $BE43
0000:     37  * *****
0000:     38  *   Hardware
0000:     39  * *****
0000:     40  KEYDATA   EQU   $C000
0000:     41  ALTSET    EQU   $C00F
0000:     42  COL80     EQU   $C01F
0000:     43  TEXT1     EQU   $C054
0000:     44  TEXT2     EQU   $C055

0000:     46  * *****
0000:     47  *   ProCursOr
0000:     48  * *****

----- NEXT OBJECT FILE NAME IS PROCURSOR
02E9:      49  ORG      $2E9
02E9:AD 36 BE      50  LDA      DOSIN      ;Set up Basic System
02EC:8D 83 03      51  STA      EXITVECT    ; Global Page vectors
02EF:AD 37 BE      52  LDA      DOSIN+1    ; and exit address
02F2:8D 84 03      53  STA      EXITVECT+1
02F5:A9 00         54  LDA      #>PROCUR
02F7:8D 36 BE      55  STA      DOSIN
02FA:A9 03         56  LDA      #<PROCUR
02FC:8D 37 BE      57  STA      DOSIN+1
02FF:60           58  RTS

0300:     60  * *****
0300:     61  *   Cursor Flashing Routine
0300:     62  * *****
0300:2C 44 BE      63  PROCUR   BIT   IFILACTV    ;Check to see if text
0303:30 05 030A    64  BMI      JMPEXIT      ; file is being input
0305:2C 43 BE      65  BIT      EXACTV      ; or EXEC file active
0308:10 03 030D    66  BPL      FLASH      ; and skip ProCursOr if
030A:4C 82 03      67  JMPEXIT   JMP   EXIT      ; either is
030D:48           68  FLASH     PHA
030E:85 FC         69  STA      CHAR      ;Save original character
0310:8A           70  TXA          ; and registers
0311:48           71  PHA
0312:98           72  TYA
0313:48           73  PHA
0314:A9 00         74  LDA      #$00      ;Clear special character
0316:85 FE         75  STA      SPECIAL    ; flag
0318:2C 1F C0      76  BIT      COL80      ;If 80-Column Card is on
031B:10 1F 033C    77  BPL      CHKCHAR    ; then clean up the
031D:A4 24         78  LDY      HCUR      ; Monitor's attempt
031F:A5 FC         79  LDA      CHAR      ; to flash the screen
0321:91 28         80  STA      (BAS),Y    ; character
0323:AD 7B 05      81  LDA      HCUR80      ;Divide horizontal
0326:4A           82  LSR          ; cursor position by two
0327:A8           83  TAY
0328:08           84  PHP
0329:78           85  SEI      ;Lock interrupts while
032A:AD 55 C0      86  LDA      TEXT2    ; screenholes are wrong
032D:90 03 0332    87  BCC      GETOLD    ; Assume even column
032F:AD 54 C0      88  LDA      TEXT1
0332:B1 28         89  GETOLD   LDA      (BAS),Y
0334:85 FC         90  STA      CHAR      ; Nope it's an odd column
0336:85 FD         91  STA      OLDCHAR    ; Pick up the character
0338:AD 54 C0      92  LDA      TEXT1    ; and save it
033B:28           93  PLP          ; Restore to page 1

033C:     95  * *****
033C:     96  *   Check original character for special values
033C:     97  * *****

```

Nibble Light Pen, ProDOS Directory List, ProCursOr, DISPLAY and programs from Nibbling at Assembly Language V are available on diskette for an introductory price of \$17.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

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continued on next page

APPLE Ile, Iic (128K, 80-Column Monitor, Two Drives)

not be installed again unless you have disabled it or rebooted. To disable PROCURSOR, enter the following two POKES:

POKE 48694,PEEK(899): POKE 48695, PEEK(900)

ENTERING THE PROGRAM

With an Assembler

If you have an assembler, enter the program as shown in Listing 1. PROCURSOR produces a solid block cursor on the enhanced //e or //c. To produce a version that displays a solid block cursor on the original //e, enter Listing 1 as shown and save the object code. Then perform the following steps to install a patch:

1. BLOAD PROCURSOR
2. CALL -151
3. Enter the patch: 33C:4C 58 03
4. BSAVE PROCURSOR,A\$2E9,L\$DA

To save PROCURSOR with a custom cursor, determine the character code for the cursor you want to use, assemble Listing 1, and follow the patch procedure described above, substituting the following patch:

33C: A9 80 85 FE A9 code 85 FF 4C 58 03

where *code* is the ASCII code of the new cursor character in hexadecimal notation.

If you have entered PROCURSOR using an assembler, you do not need to enter Listing 2.

Without an Assembler

If you don't have an assembler, do not try to enter Listing 1. Instead, enter the Apple-soft program in Listing 2 and save it on disk with the command:

SAVE PROCURSOR.INST

After you run this program and select the cursor you want, it will automatically create the machine language program. When the program ends, you may save the resulting machine language program with the command:

BSAVE PROCURSOR,A\$2E9,L\$DA

For help in entering *Nibble* listings, see "A Welcome to New *Nibble* Readers" at the beginning of this issue.

HOW IT WORKS

My first thought in writing ProCursor was to tap into the BASIC interpreter's input/output structure. Unfortunately, there is no one area in the BASIC interpreter (BI) where a patch could be made that would remain valid after any revision of the BI.

Finally, I came up with the best method to flash the cursor: any request for a keypress (through the Monitor keyboard input vector) is directed to PROCURSOR instead of to the BI's keyboard intercept routine. (In other words, we're intercepting the request for a keypress twice.) PROCURSOR flashes

LISTING 1: PROCURSOR (continued)

```

033C:A5 FC          9B CHKCHAR LDA CHAR          ;Check original character
033E:C9 E0          99          CMP #E0          ; for the values $C0-$DF
0340:B0 16          0358 100        BCS GETKEY      ; and change them to
0342:C9 C0          101          CMP #C0          ; $80-$9F to avoid //c
0344:90 04          034A 102        BCC CHKCHAR1    ; special characters
0346:E9 40          103          SBC #40
0348:85 FC          104          STA CHAR          ;Check for a //c special
034A:C9 60          0358 106        BCS GETKEY      ; character and set flag
034C:B0 0A          107          CMP #40          ; and save a space as the
034E:C9 40          0358 108        BCC GETKEY      ; negative cursor image
0350:90 06          109          LDA #A0
0352:A9 A0          110          STA SPECIAL
0354:85 FE          111          STA BNKCHAR
0356:85 FF

0358:              113 *****
0359:              114 * Get keypress while flashing cursor
035A:              115 *****
035B:20 85 03       116 GETKEY JSR BLINK          ;Blink cursor
035D:E6 4E          117          INC RNDL          ;Increment random number
035F:D0 02          0361 118        BNE GETKEY1     ; for monitor
0361:E6 4F          119          INC RNDH
0363:A2 FF          120 GETKEY1 LDX #FF
0365:86 FB          121          STX WAITLEN
0367:2C 00 C0       122 KEYWAIT1 BIT KEYDATA      ;Check for keypress
0369:30 09          0373 123        BMI KEYFND      ;Yes, key was pressed
036A:CA          124 KEYWAIT2 DEX                ;Wait for a bit then
036B:D0 FD          036A 125        BNE KEYWAIT2    ; check key again
036D:C6 FB          126          DEC WAITLEN
036F:D0 F4          0365 127        BNE KEYWAIT1    ;Okay waited long enough
0371:F0 E5          0358 128        BEQ GETKEY      ; blink cursor again
0373:2C 1F C0       129 KEYFND BIT COL80          ;If 80-Column Card is on
0375:10 05          037D 130        BPL KEYFNDX    ; then repair the screen
0377:A5 FD          131          LDA OLCCHAR
0379:20 AB 03       132          JSR STORE
037B:D0 68          133 KEYFNDX PLA                ;Restore all registers
037D:E6 4E          134          INC RNDL          ; before calling real
037F:D0 68          135          BPL KEYFNDX      ; input routine
0381:AA          136          TAX
0383:68          137          PLA

0382:              139 *****
0383:              140 * Exit vector
0384:              141 *****
0385:4C          142 EXIT DFB $4C          ;Call real input routine
0387:00 00          143 EXITVECT DW $0000

0385:              145 *****
0386:              146 * Blink Cursor
0387:              147 *****
0388:8D 0F C0       148 BLINK STA ALTSET          ;Blink cursor
038A:24 FE          149          BIT SPECIAL      ;If a special character
038C:10 0B          0397 150        BPL BLINK1      ; is on screen
038E:A6 FF          151          LDX BNKCHAR      ; then switch character
0390:A5 FC          152          LDA CHAR          ; with negative cursor
0392:85 FF          153          STA BNKCHAR      ; character
0394:8A          154          TXA
0396:85 FC          155          STA CHAR
0398:D0 06          039D 156        BNE SAVE        ;Make character opposite
039A:A5 FC          157 BLINK1 LDA CHAR          ; mode
039C:49 80          158          EOR #80
039E:85 FC          159          STA CHAR
03A0:2C 1F C0       160 SAVE BIT COL80          ;Save cursor on screen
03A2:30 07          03A9 161        BMI SAVE80      ;Save on 40-column screen
03A4:A4 24          162          LDY HCUR          ;Save on 40-column screen
03A6:A5 FC          163          LDA CHAR
03A8:91 28          164          STA (BAS).Y
03AA:60          165          RTS
03AC:A5 FC          166 SAVE80 LDA CHAR          ;Save on 80-column screen

03AB:              168 *****
03AB:              169 * Store character on screen
03AB:              170 *****
03AB:48          171 STORE PHA
03AC:AD 7B 05       172          LDA HCUR80          ;Divide horizontal
03AE:4A          173          LSR                ; cursor position by two
03B0:A8          174          TAY
03B2:68          175          PLA
03B4:08          176          PHP
03B6:78          177          SEI                ;Set interrupt disable
03B8:2C 55 C0       178          BIT TEXT2      ;Assume even column
03BA:90 03          03BC 179        BCC STORE1
03BC:2C 54 C0       180          BIT TEXT1      ;Nope-odd column
03BE:91 28          181 STORE1 STA (BAS).Y      ;Store onto the screen
03C0:2C 54 C0       182          BIT TEXT1
03C2:28          183          PLP
03C4:60          184          RTS

```

END OF LISTING 1

KEY PERFECT 5.0 RUN ON PROCURSOR			
CODE-5.0	ADDR#	ADDR#	CODE-4.0
489ED784	02E9	0338	29BE
6536602A	0339	0388	2909
9D6BC6E3	0389	03C2	2166
7B353FCB	= PROGRAM TOTAL =		DA

cursor (as long as an EXEC file isn't in effect or a text file isn't being read from) and jumps to the original intercept routine (in the BI).

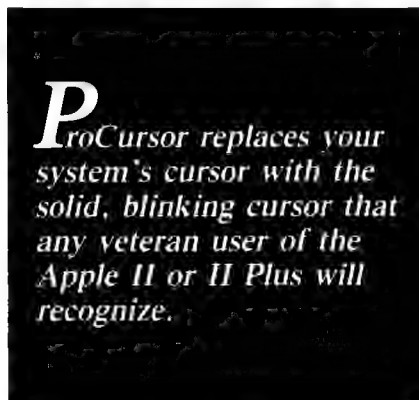
When PROCURSOR is run, lines 50-53 in Listing 1 save the original keyboard interrupt routine address (at \$383) for branching after each keypress. Lines 54-58 set the keyboard interrupt to point to the beginning of PROCURSOR (the Monitor's vector at \$28 is set by the BI).

When PROCURSOR is installed, a jump is made from any routine that uses the standard keyboard input routines to the beginning of PROCURSOR (line 63). From here, lines 63-67 determine if a text file is being read or if an EXEC file is active. The program exits to the normal input routine if either one is active. Next, lines 68-76 save the processor registers and the original screen character (also, the special flag is cleared).

Lines 76-77 check to see if the 80-column screen is on; if not, program flow skips to line 98. If the screen is on, lines 78-80 repair the Monitor's attempt to flash the character on the screen. Lines 81-93 pick up the correct character from the screen and save it in CHAR and OLDCHAR.

Lines 98-104 check the original character for a value between \$C0 and \$DF and change the character to eliminate Mousetext on the Apple //c (values \$40-\$5F) on the inverse blink. Lines 105-111 check for a Mousetext character, set the SPECIAL flag and set the blink character to a normal space character (\$A0).

If you elected to install the original //e patch or the custom cursor patch, the code at \$3CC will be different. In the case of the original //e, the first instruction will be a JMP \$358, which skips the check for Mousetext characters. The custom cursor



patch makes the program think that the original character was a Mousetext character and loads the Accumulator with the code for the custom character before jumping to \$358.

If a key was pressed, lines 129-132 restore the original character to the 80-column screen. Lines 133-137 restore the registers before calling the real input routine. The exit vector (lines 142-143) jumps to the address that was in memory locations \$BE36 and

\$BE37 when PROCURSOR was installed.

The cursor blinking routine is in lines 148-166. Lines 148-156 swap the original character and the blink character, and save the result on the screen if the special flag is set. Lines 157-159 change the high bit on the character to switch it from normal to inverse or vice versa. Lines 160-166 save the new cursor character on the screen. Finally, lines 171-184 make up the 80-column character storage routine.

CUSTOMIZING THE CURSOR

When using PROCURSOR with the patch to blink the original character with a character of your choice, you can change the blink character by entering:

POKE 833, code

where code is the character code for your new cursor. This allows you to use different cursors for different inputs. For instance, you could use an underline for strings and a plus sign for numbers.

PROBLEMS WITH PROCURSOR

There are two minor problems with ProCursor that can't be fixed without altering ProDOS, the BASIC interpreter or the 80-column firmware. If you leave escape mode when the 80-column firmware is in effect, the cursor reverts to the checkerboard until the next keypress. Also, if you use the right arrow key to trace over a Mousetext character on the //c (but not the enhanced //e), it turns into an inverse upper-case character, and vice versa.

LISTING 2: PROCURSOR.INST

```
10 REM *****
20 REM * PROCURSOR INST *
30 REM * BY JIM LAZAR *
40 REM * COPYRIGHT (C) 1986 *
50 REM * BY MICROSPARC, INC *
60 REM * CONCORD, MA 01742 *
70 REM *****
80 REM
90 IF PEEK (64435) < > 6 THEN HOME : VTAB
12: PRINT "THIS IS NOT A //e OR A //c.":
END
100 IF PEEK (48694) = 0 AND PEEK (48695) =
3 THEN POKE 48694, PEEK (899): POKE 486
95, PEEK (900)
110 HOME : PRINT "ProCursor": PRINT : PRINT
"By Jim Lazar": PRINT : PRINT : PRINT "C
opyright 1986": PRINT "by MicroSPARC, I
nc.": PRINT : PRINT : PRINT
120 PRINT "1-Solid Blinking Box": PRINT "2-C
ustom Character": PRINT
130 PRINT : INPUT "Enter version to install:
":A$: IF VAL (A$) < 1 OR VAL (A$) > 2
THEN PRINT CHR$ (7):: GOTO 130
140 VER = 3 * (A$ = "2") + (A$ = "1") * (2 -
( PEEK (64448) = 234)): IF VER < > 3 THEN
170
150 PRINT : INPUT "Enter blink character num
ber: ":A$: IF VAL (A$) < 0 OR VAL (A$)
> 255 THEN PRINT CHR$ (7):: GOTO 150
160 CHAR = VAL (A$)
170 FOR A = 745 TO 962: READ B: POKE A,B: NEXT
```

```
180 IF VER = 2 THEN POKE 828,76: POKE 829,8
8: POKE 830,3: FOR A = 831 TO 855: POKE
A,234: NEXT : GOTO 210
190 IF VER = 1 THEN 210
200 FOR A = 828 TO 838: READ B: POKE A,B: NEXT
: POKE 833,CHAR: FOR A = 839 TO 855: POKE
A,234: NEXT
210 CALL 745: HOME : PRINT "ProCursor 1."VER
" is installed"
220 DATA 173,54,190,141,131,3,173,55,190,141
,132,3,169,0,141,54,190,169,3,141,55,190
,96,44,68,190,48,5,44,67,190,16,3,76,130
,3,72,133,252,138,72,152,72,169,0,133,25
4,44,31,192,16,31,164,36,165,252,145,40
230 DATA 173,123,5,74,168,8,120,173,85,192,1
44,3,173,84,192,177,40,133,252,133,253,1
73,84,192,40,165,252,201,224,176,22,201,
192,144,4,233,64,133,252,201,96,176,10,2
01,64,144,6,169,160,133,254,133,255,32,1
33,3,230,78
240 DATA 208,2,230,79,162,255,134,251,44,0,1
92,48,9,202,208,253,198,251,208,244,240,
229,44,31,192,16,5,165,253,32,171,3,104,
168,104,170,104,76,0,0,141,15,192,36,254
,16,11,166,255,165,252,133,255,138,133
250 DATA 252,208,6,165,252,73,128,133,252,44
,31,192,48,7,164,36,165,252,145,40,96,16
5,252,72,173,123,5,74,168,104,8,120,44,8
5,192,144,3,44,84,192,145,40,44,84,192,4
0,96
260 DATA 169,128,133,254,169,0,133,255,76,88
,3
```

END OF LISTING 2

DISPLAY

A ProDOS VAR File Reader

by Ken Manly

APPLE UTILITIES

The ProDOS VAR

type file has many uses, including saving memory, increasing speed, and helping with program debugging. Add the DISPLAY command to ProDOS and you can view the contents of any VAR file.

Of the new features that ProDOS brings to Applesoft programming, the VAR file is one of the most useful. VAR files are disk files that contain the names and values of all real, integer and string variables in an Applesoft program. The STORE command creates the VAR file on disk. The RESTORE command loads the variables and their values from disk and substitutes them for any current Applesoft variables.

However, without a program, there is no easy way to see the contents of a VAR file. With DISPLAY, a new command is added to ProDOS that lists the contents of a VAR file.

There are many potential uses for VAR files. Let's consider three: First, a VAR file is a fast and memory-efficient way to initialize program variables. To set up an initialization file, type CLEAR, then type each of the variable definitions you want in your program. Save it with the STORE command followed by your file name. For example, STORE SETUP. Then include the instruction:

```
PRINT CHR$(4)"RESTORE SETUP"
```

at the beginning of your program. This method works faster than having your pro-

gram read values from text files and it requires less memory than multiple assignment statements or data statements.

Second, a VAR file is a good way to preserve the current state of a program while it carries out another task. Suppose that you occasionally want your program to sort using a very large array. Having the array defined all the time is a waste of precious memory. Using VAR files, you can STORE the current variables, CLEAR memory, define and use your large array, and RESTORE the current variables. When you use the RESTORE command, the space occupied by the large array is cleared, the current variables are restored, and your program goes back to where it left off. If you have an Apple //c or a //e with an extended 80-column card, you can STORE to and RESTORE from the /RAM disk emulator. Storage to /RAM is so quick that the delay may not be noticeable.

Third, VAR files can be useful in program debugging. You can get a snapshot of what the variables look like at any point in your program by inserting a statement such as:

```
PRINT CHR$(4)"STORE VARBL5"
```

If some of the variables in this VAR file do not have their expected values, you have a good idea of where the bug is hiding.

DISPLAY

The third use raises a question: How can you examine the contents of a VAR file?

You DISPLAY it, of course. To add the DISPLAY command to ProDOS, just BRUN DISPLAY (Listing 1).

The DISPLAY command can be used with slot and drive parameters:

```
DISPLAY filename,[Sslot#,Ddrive#]
```

or it can be used with a ProDOS pathname:

```
DISPLAY pathname
```

Examples of each are:

```
DISPLAY VARBL5,S6,D2  
DISPLAY /MYDISK/VARBL5
```

Like other ProDOS commands, DISPLAY can be used from within a program in a PRINT statement preceded by a <CTRL>D as in:

```
PRINT CHR$(4)"DISPLAY SETUP"
```

The specified file must be a VAR type file.

A sample DISPLAY output is shown in **Example 1**. Control characters are indicated by a normal character enclosed in square brackets. Any strings of zero length are identified by "Empty string." Simple variables are displayed first, followed by arrays, both in the order in which they were defined. Array elements are listed in order, starting with the zero element. In listing multidimensional array elements, the first index is the least significant and the last index is the most significant. For example, if BX() is dimensioned as BX(1,1), its elements would be listed in the order: BX(0,0), BX(1,0),

Ken Manly, Buffalo Chip Software, 35 Tillinghast Pl., Buffalo, NY 14216. DISPLAY is compatible with ProDOS only.

EXAMPLE 1: Sample DISPLAY Output

```
D $ = [D]
AB = 25.72
TL% = 3
DT$ = JULY 4, 1984
TY = Function definition
X = 0
I = 6
J = 3
NL$ = Empty string
AR(2,2) =
0
1
4
.1
1.1
4.1
.2
1.2
4.2

ST$(5) =
JU
JULY
JULY 4
JULY 4,
JULY 4, 19
JULY 4, 1984
```

BX(0,1), and BX(1,1).

An array listing can be very long, and you may not need to display all of it. Pressing <ESC> or <CTRL>C during an array listing will cause DISPLAY to stop listing that array and begin listing the next array. Another way to minimize array listing length is to explicitly dimension arrays that are smaller than the default dimension of ten.

The speed of the display can be controlled by the Applesoft SPEED command, and the display can be sent to a printer or other output device with the ProDOS PR#n command. DISPLAY is compatible with other ProDOS add-on commands that use the recommended installation methods.

Some of DISPLAY's screen instructions and error messages contain lower-case letters, but if DISPLAY is run on an Apple II Plus, lower-case letters are converted to upper-case as they are printed. Lower-case letters in a VAR file will not be converted, however, on the assumption that the Apple II Plus must have been modified to allow display of lower-case.

USING DISPLAY

Let's look at an example of using DISPLAY. Suppose you have a program that uses text files often. Some of your ProDOS commands are assigned to string variables; for example, D\$=CHR\$(4), OP\$=D\$+"OPEN", and CL\$=D\$+"CLOSE". These are stored in a VAR file called VBLS. The program statement:

PRINT CHR\$(4)"RESTORE VBLS"

loads all the variables, but when you go back

Nibble Light Pen, ProDOS Directory List, ProCursor, DISPLAY and programs from Nibbling at Assembly Language V are available on diskette for an introductory price of \$17.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: DISPLAY

```
0000: 1 LST ON,G
0000: 2 .....
0000: 3 *
0000: 4 * DISPLAY *
0000: 5 * by Ken Manly *
0000: 6 * Buffalo Chip Software *
0000: 7 *
0000: 8 * Copyright (C) 1986 *
0000: 9 * by MicroSPARC, Inc. *
0000: 10 * Concord, MA 01742 *
0000: 11 *
0000: 12 * EDASM.SYSTEM *
0000: 13 *
0000: 14 .....
0000: 15 ;
0000: 002F 16 LENGTH EQU $2F
0000: 003C 17 A1L EQU $3C
0000: 003A 18 PCL EQU $3A
0000: 003E 19 A2L EQU $3E
0000: 0042 20 A4L EQU $42
0000: 005E 21 INDEX EQU $5E
0000: 0069 22 VARTAB EQU $69
0000: 0073 23 HIMEM EQU $73
0000: 00FC 24 BUFPTR EQU $FC
0000: 00FE 25 PRTPTR EQU $FE
0000: 0100 26 STACK EQU $100
0000: 0200 27 INPUT EQU $200
0000: BE06 28 EXTRNCMD EQU $BE06
0000: BE0C 29 PRINTER EQU $BE0C
0000: BE50 30 XTRNADDR EQU $BE50
0000: BE52 31 XLEN EQU $BE52
0000: BE53 32 XCNUM EQU $BE53
0000: BE54 33 PBITS EQU $BE54
0000: BE6C 34 VPATH1 EQU $BE6C
0000: BE70 35 GOSYSTEM EQU $BE70
0000: BE9E 36 XRETURN EQU $BE9E
0000: BEB4 37 SSGINFO EQU $BEB4
0000: BEB8 38 FIFILID EQU $BEB8
0000: BEB9 39 FIAUXID EQU $BEB9
0000: BEBC 40 FIBLOKS EQU $BEBBC
0000: BECE 41 OSYSBUF EQU $BECE
0000: BED0 42 OREFNUM EQU $BED0
0000: BED6 43 RWREFNUM EQU $BED6
0000: BED7 44 RWDATA EQU $BED7
0000: BED9 45 RWCOUNT EQU $BED9
0000: BEDE 46 CREFNUM EQU $BEDE
0000: BEF5 47 GETBUFR EQU $BEF5
0000: BF58 48 BITMAP EQU $BF58
0000: BF98 49 MACHID EQU $BF98
0000: C000 50 KBD EQU $C000
0000: C010 51 KBSTROBE EQU $C010
0000: C030 52 CLICK EQU $C030
0000: DAFB 53 CRDO EQU $DAFB
0000: DB5C 54 OUTDO EQU $DB5C
0000: DEF3 55 INTOFAC1 EQU $DEF3
0000: ED24 56 LINPRT EQU $ED24
0000: EAF9 57 MOVFM EQU $EAF9
0000: ED2E 58 PRNTFAC EQU $ED2E
0000: F88C 59 INSDS2 EQU $F88C
0000: F953 60 PCADJ EQU $F953
0000: FCA8 61 WAIT EQU $FCA8
0000: FD75 62 NXTCHAR EQU $FD75
0000: FE2C 63 MOVE EQU $FE2C
0000: 64 ;
0000: 65 ;ProDOS MLI function call codes
0000: 66 ;
0000: 00CA 67 READ EQU $CA
0000: 00C4 68 GETINFO EQU $C4
0000: 00C8 69 OPEN EQU $C8
0000: 00CC 70 CLOSE EQU $CC
0000: 71 ;
0000: 72 MSB ON
----- NEXT OBJECT FILE NAME IS DISPLAY
2000: 2000 73 ORG $2000
2000: 74 ;
2000: A9 04 75 LDA #<LAST-BEGIN+$100 ;Ask BASIC to
2002: 20 F5 BE 76 JSR GETBUFR ; reserve space
2005: 8D 3A 21 77 STA ORIG ;Remember where it is
2008: 85 3C 78 STA A1L
200A: 38 79 SEC
200B: E9 22 80 SBC #<BEGIN ;Subtract present location
200D: 8D 3B 21 81 STA RELO ; to see how far program
2010: A9 04 82 LDA #<LAST-BEGIN+$100 ; will have to be
2012: 85 3D 83 STA A1L+1 ; moved
2014: A5 3C 84 PROTECT LDA A1L ;Protect program space
```

continued on page 79

to work on the program, you cannot remember whether you included the append command (AP\$=D\$+"APPEND") in your file. To find out, BRUN DISPLAY to install the command. Successful installation is indicated by the title and copyright notice. Now type:

DISPLAY VBLS

You should see something like this:

```
D $ = [D]
OP$ = [D]OPEN
CL$ = [D]CLOSE
RD$ = [D]READ
WR$ = [D]WRITE
```

The APPEND command is not defined, so add it by typing three commands:

```
RESTORE VBLS
AP$=D$+"APPEND"
STORE VBLS
```

This procedure is simple if you have a very small VAR file. What if you have defined too many variables to fit on the screen, and they scroll off the screen before you can read through them? There are three things you can do. First, you can use <CTRL>S to make the listing pause. Type <CTRL>S again to continue. Second, you can type SPEED=100 before you type the DISPLAY command. This will slow down the display so you can read everything as it scrolls by. Third, you can print out your display by typing PR#n (where n is the slot number of your printer interface) before the DISPLAY command.

ENTERING DISPLAY

Use the Monitor to type in the DISPLAY program from the assembly language listing (Listing 1). Save it with the command:

```
BSAVE DISPLAY,AS$2000,L$5CB
```

If you enter the program with an assembler, note that there is one convention used by Apple's EDASM.SYSTEM that is exactly the opposite in assemblers such as Big Mac or Merlin. In EDASM.SYSTEM, the statement #<EXP refers to the high byte of the two-byte value EXP, and #>EXP refers to the low byte.

For help in entering Nibble listings, see "A Welcome to New Nibble Readers" at the beginning of this issue.

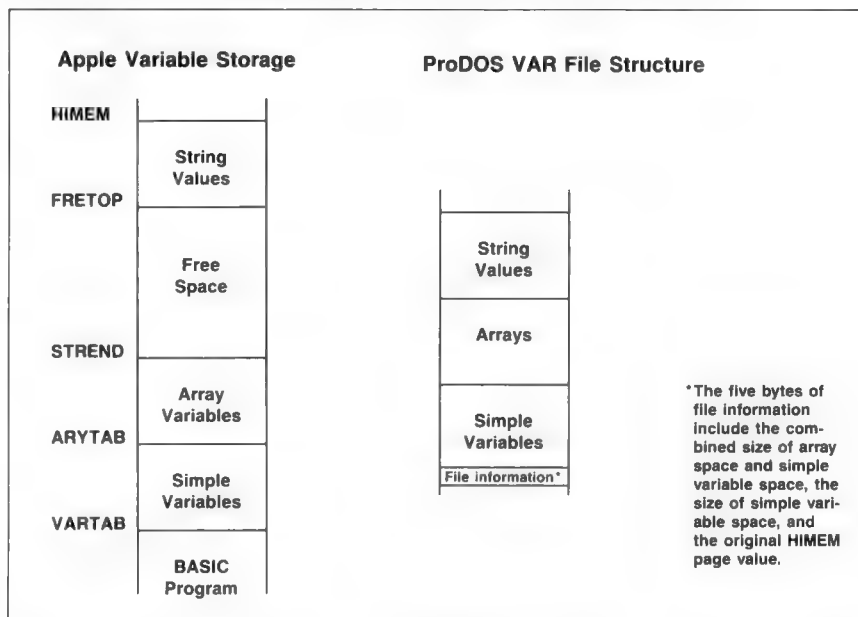
ANATOMY OF A VAR FILE

Figures 1 and 2 diagram the internal structure of VAR files.

Variable Storage

Figure 1 shows how Applesoft variables are stored in memory. Simple variables (as opposed to array variables) are stored immediately above the Applesoft program in memory. Each variable occupies seven bytes, two for the first two characters of the variable name and five for the actual value, in the case of floating point or integer vari-

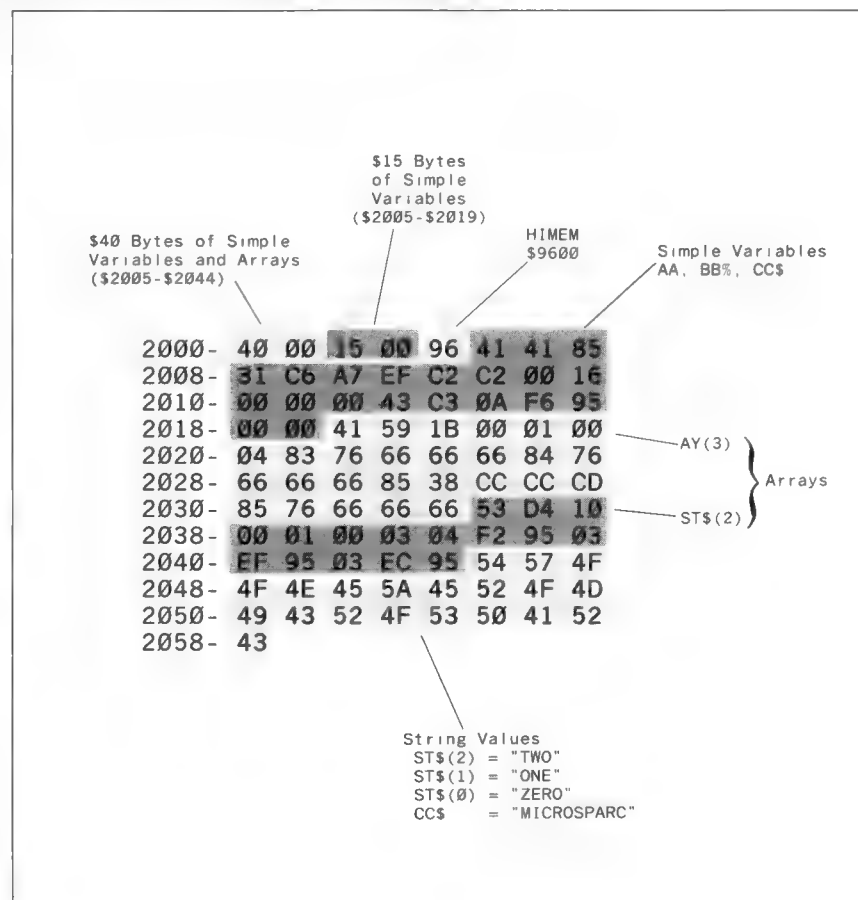
FIGURE 1: Applesoft Variable Storage and ProDOS VAR File Structure



ables, or an address, in the case of string variables or function definitions. (Details on each type of variable can be found in the *Applesoft BASIC Programmer's Reference Manual*.)

Array variables are stored in a separate area in memory, just above the simple variables, and each element of an array has a structure similar to a simple variable of the same type. The actual characters in each

FIGURE 2: VAR File BLOADED at Address \$2000



LISTING 1: DISPLAY (continued)

```

2016:20 A9 20      85      JSR  SETBIT      ; from ProDOS by setting
2019:E6 3C          86      INC  A1L          ; bits in the bitmap
201B:C6 3D          87      DEC  A1L+1        ;
201D:D0 F5 2014    88      BNE  PROTECT
201F:              89      ;
201F:AD 08 BE      90      LDA  EXTRNCMD+2    ;Link DISPLAY into the
2022:8D 34 22      91      STA  TRYNEXT+2    ; chain of external
2025:AD 07 BE      92      LDA  EXTRNCMD+1    ; commands, if any
2028:8D 33 22      93      STA  TRYNEXT+1
202B:AD 3A 21      94      LDA  ORIG          ; If DISPLAY cannot
202E:8D 08 BE      95      STA  EXTRNCMD+2    ; recognize a command,
2031:A9 00          96      LDA  #0           ; it will pass control
2033:8D 07 BE      97      STA  EXTRNCMD+1    ; to next routine
2036:              98      ;
2036:A9 00          99      LDA  #>BEGIN      ;To start relocation,
2038:85 3A          100     STA  PCL          ; point program
203A:A9 22          101     LDA  #<BEGIN      ; counter at beginning
203C:85 3B          102     STA  PCL+1        ; of program
203E:A2 00          103     LDX  #0
2040:20 8C F8      104     JSR  INSDS2      ;Disassemble an opcode
2043:B1 3A          105     LDA  (PCL),Y      ;Check opcode
2045:F0 28 206F    106     BEQ  FIXADDR      ;BRK means end of code
2047:A4 2F          107     LDY  LENGTH      ;Only 3-byte
2049:C0 02          108     CPY  #2           ; instructions need
204B:D0 10 205D    109     BNE  FX1          ; fixing
204D:B1 3A          110     LDA  (PCL),Y      ;Only instructions
204F:C9 22          111     CMP  #<BEGIN      ; referring to address
2051:90 0A 205D    112     BCC  FX1          ; within program
2053:C9 26          113     CMP  #<LAST+$100   ; need fixing
2055:B0 06 205D    114     BCS  FX1
2057:18            115     CLC              ;Fix by adding RELO
2058:6D 3B 21      116     ADC  RELO          ; offset to hi byte
205B:91 3A          117     STA  (PCL),Y      ; of address
205D:20 53 F9      118     JSR  PCADJ
2060:85 3A          119     STA  PCL
2062:84 3B          120     STY  PCL+1
2064:4C 3E 20      121     JMP  FIXLOOP
2067:              122     ;
2067:18            123     FXTBLP CLC          ;Add RELO offset to
2068:6D 3B 21      124     ADC  RELO          ; hi byte of each
206B:99 5C 25      125     STA  ATBL,Y        ; address in the table
206E:C8            126     INY              ;Next address
206F:C8            127     INY
2070:B9 5C 25      128     LDA  ATBL,Y        ;0 means end of
2073:D0 F2 2067    129     BNE  FXTBLP      ; table
2075:              130     ;
2075:A0 00          131     LDY  #0           ;Move program to
2077:84 3C          132     STY  A1L          ; the space reserved
2079:A9 22          133     LDA  #<BEGIN      ; for it, using the
207B:85 3D          134     STA  A1L+1        ; monitor MOVE routine
207D:A9 CB          135     LDA  #>LAST
207F:85 3E          136     STA  A2L
2081:A9 25          137     LDA  #<LAST
2083:85 3F          138     STA  A2L+1
2085:84 42          139     STY  A4L
2087:AD 3A 21      140     LDA  ORIG
208A:85 43          141     STA  A4L+1
208C:20 2C FE      142     JSR  MOVE
208F:              143     ;
208F:A2 7A          144     LDX  #BANNER1-BANNER0
2091:A0 00          145     LDY  #0
2093:B9 C0 20      146     LDA  BANNER0,Y
2096:2C 98 BF      147     BIT  MACHID      ;Check for Apple II+
2099:30 06 20A1    148     BMI  BNROUT
209B:C9 E0          149     CMP  #$E0          ;Convert lower case
209D:90 02 20A1    150     BCC  BNROUT      ; to upper case
209F:29 DF          151     AND  #%11011111   ; for II+
20A1:20 5C DB      152     JSR  OUTDO       ;Print greeting
20A4:C8            153     INY
20A5:CA            154     DEX
20A6:D0 EB 2093    155     BNE  BNRLP
20A8:60            156     RTS              ;End of installation
20A9:              157     ;
20A9:48            158     SETBIT PHA          ;This subroutine protects
20AA:29 07          159     AND  #$07        ; the memory page whose hi
20AC:AA            160     TAX              ; address byte is in A
20AD:68            161     PLA
20AE:4A            162     LSR              ;Upper
20AF:4A            163     LSR              ; five bits of A
20B0:4A            164     LSR              ; make an index into
20B1:A8            165     TAY              ; the bitmap
20B2:A9 00          166     LDA  #0           ;Lower three bits of A
20B4:38            167     SEC              ; choose the bit
20B5:6A            168     ROR              ; to be set--X counts
20B6:CA            169     DEX              ; while bit is shifted
20B7:10 FC 20B5    170     BPL  SETLP       ; from carry bit
20B9:19 58 BF      171     ORA  BITMAP,Y
20BC:99 58 BF      172     STA  BITMAP,Y      ;Set the bit in the bitmap
20BF:60            173     RTS
20C0:              174     ;
20C0:A0 A0 A0 A0    175     BANNER0 ASC  '      DISPLAY'
20C4:A0 A0 A0 A0
20C8:A0 A0 A0 A0
20CC:A0 A0 A0 A0
20D0:C4 C9 D3 D0
20D4:CC C1 D9
20D7:8D            176     DB  $8D

```

continued on page 82

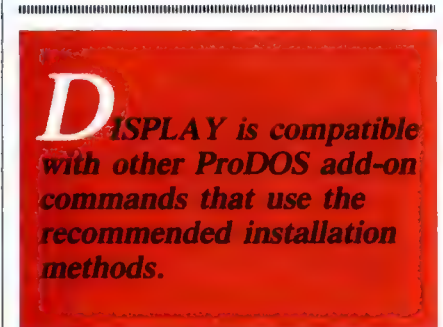
string are stored in a separate block of memory just below ProDOS and its buffers.

Figure 1 also shows how these three variable storage areas are put into a variable file. Each area remains intact and separate. The only changes are the deletion of free space and the addition of five bytes at the beginning of the file.

File Information Storage

The five bytes provide three pieces of critical information:

1. The combined size of the simple variable and array areas
2. The size of the simple variable area alone



3. The value of the HIMEM page when the VAR file was stored

This information is used by the RESTORE command to reconstruct the variable space.

The usefulness of the third value is not immediately obvious. The value of HIMEM determines where string values are stored; if HIMEM has been changed from the original value when a VAR file is RESTORED, then the string values will be moved accordingly. But remember that string variables are stored with pointers to a different area of memory where the actual characters are stored. When the string characters are moved, the string pointers must be adjusted to accommodate the new location.

The location of the string pointers can be changed another way. ProDOS stores a load address for the VAR file in the disk catalog. If the file is loaded so that the simple variables start at this address, then all the string pointers are correct. Therefore, the pointers can be corrected by subtracting the difference between the load address stored in the disk directory and the address at which the file is actually loaded. This is, in fact, the method that DISPLAY uses to find the true locations of the string characters.

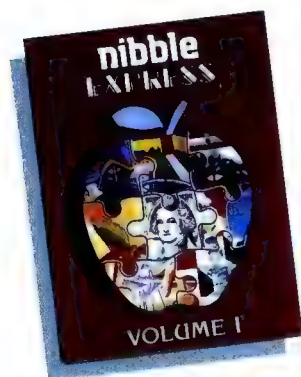
Figure 2 shows a typical VAR file in detail. The file has three simple variables: AA=22.222, BB%=22, and CC\$="MICROSPARC". It also has a real array, AY(3), and a string array, ST\$(2). The five bytes at the beginning of the file show that the simple and array variables occupy \$40 bytes (from \$2005 to \$2044), that simple

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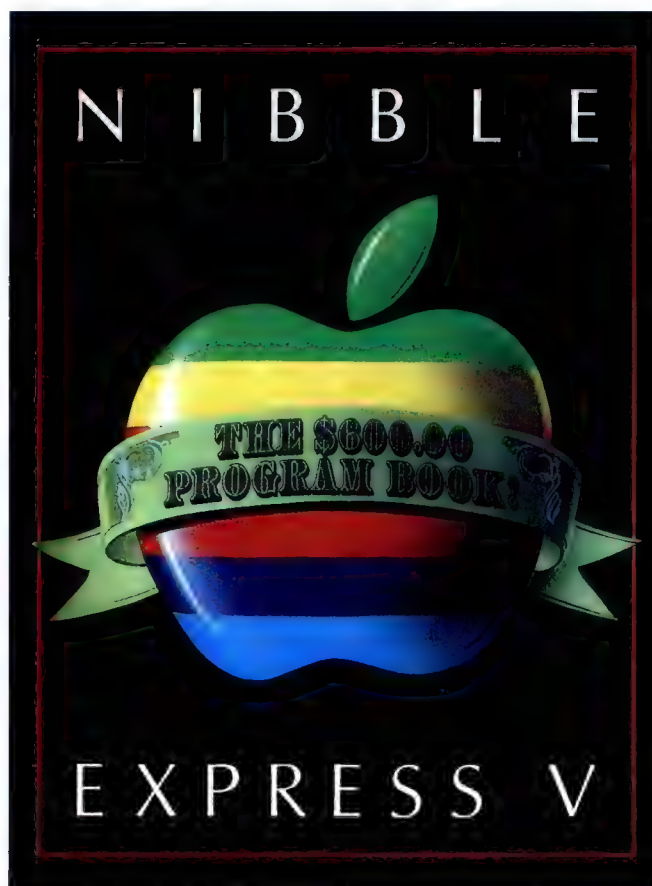
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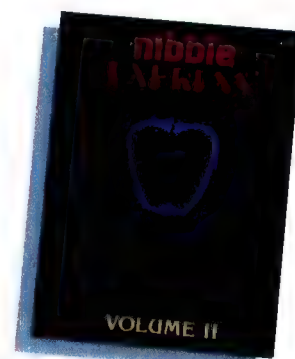
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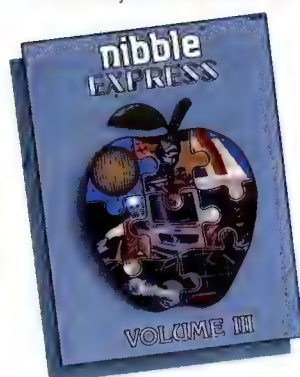
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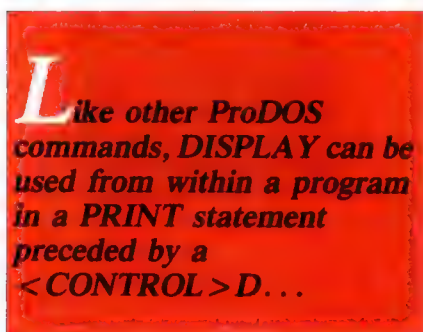
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variables alone occupy \$15 bytes (from \$2005 to \$2019), and that HIMEM was at \$9600 when the file was STOREd. Under ProDOS, HIMEM can only be set on even page boundaries. The low byte of HIMEM is always zero, so only the high byte needs to be saved.

Where's the Function?

During my investigations, I made a rather surprising discovery about function definitions in VAR files — they are missing! The function name is stored with the simple variables, but the definition itself is inside the original Applesoft program. If the program that created the definition is not present, or if the program has been changed, the function definition is not available. An attempt to use such a function will evoke a SYNTAX ERROR message. Since DISPLAY will usually be used without a program, it does not attempt to display the function definition. Instead, it prints "Function definition" to indicate that the function name has indeed been defined.



HOW DISPLAY WORKS

DISPLAY loads at \$2000. The first part of the program is a loader routine that requests space from BASIC.SYSTEM, protects that space from ProDOS, relocates the rest of DISPLAY, and connects it to ProDOS.

The idea for the relocation method came from Tom Weishaar's article, "A Type Command for ProDOS" (*Sofstalk*, Vol. 4, June, 1984). My implementation differs, however, in that the program code and data must be strictly segregated into separate sections. Furthermore, the code cannot contain instructions that refer to memory locations by immediate addressing (LDA #LOOP or LDA #> LOOP, for instance). Instead, internal addresses are placed in a separate table at the end of the program (lines 646-651 in Listing 1).

The relocation routine has two tasks. First, it adjusts the third byte of every three-byte instruction in the code section, using a Monitor subroutine to identify three-byte instructions. Second, it adjusts the second

LISTING 1: DISPLAY (continued)

20D8:A0 A0 A0 C4	177	ASC	'	Displays the values in'
20DC:E9 F3 F0 EC				
20E0:E1 F9 F3 A0				
20E4:F4 E8 E5 A0				
20E8:F6 E1 EC F5				
20EC:E5 F3 A0 E9				
20F0:EE				
20F1:A0 E1 A0 D6	178	ASC	'	a VAR file'
20F5:C1 D2 A0 E6				
20F9:E9 EC E5				
20FC:8D	179	DB	\$8D	
20FD:A0 A0 A0 A0	180	ASC	'	by Ken Manly'
2101:A0 A0 A0 A0				
2105:A0 A0 A0 A0				
2109:A0 E2 F9 A0				
210D:CB E5 EE A0				
2111:CD E1 EE EC				
2115:F9				
2116:8D	181	DB	\$8D	
2117:A0 A0 A0 A0	182	ASC	'	(C) 1986 by '
211B:A0 A0 A8 C3				
211F:A9 A0 B1 B9				
2123:B8 B6 A0 E2				
2127:F9 A0				
2129:CD E9 E3 F2	183	ASC	'	MicroSPARC, Inc.'
212D:EF D3 D0 C1				
2131:D2 C3 AC A0				
2135:C9 EE E3 AE				
2139:8D	184	DB	\$8D	
213A: 213A	185	EQU	*	BANNER1
213A: 0001	186	DS	1	ORIG
213B: 0001	187	DS	1	RELO
213C:	188			
213C: 003C	189	EQU	>*	HERE
213C: 00C4	190	DS	\$100	-HERE
2200:	191			
2200:A2 00	192	LDX	#0	:Compare command in the
2202:BD 00 02	193	LDA	INPUT,X	: input buffer with
2205:DD 86 25	194	CMP	CMD+1,X	: our command (DISPLAY)
2208:D0 27 2231	195	BNE	NOTOURS	:Mismatch--not our cmd
220A:E8	196	INX		
220B:EC 85 25	197	CPX	CMD	
220E:D0 F2 2202	198	BNE	NXTCHR	
2210:	199			
2210:CA	200	DEX		:Command matched
2211:8E 52 BE	201	STX	XLEN	:The length of our cmd
2214:AD 5C 25	202	LDA	T-BEGIN0	:Tell ProDOS where
2217:8D 50 BE	203	STA	XTRNADDR	: the execution code
221A:AD 5D 25	204	LDA	T-BEGIN0+1	: for this command is
221D:8D 51 BE	205	STA	XTRNADDR+1	
2220:A9 00	206	LDA	#0	:Indicate external command
2222:8D 53 BE	207	STA	XCNUM	
2225:A9 81	208	LDA	##10000001	:Tell parser to use prefix
2227:8D 54 BE	209	STA	PBITS	: and expect a filename
222A:A9 04	210	LDA	##00000100	:Tell parser to allow
222C:8D 55 BE	211	STA	PBITS+1	: slot & drive number
222F:18	212	CLC		:Tell ProDOS command is OK
2230:60	213	RTS		
2231:	214			
2231:38	215	SEC		:Tell ProDOS command is
2232:4C 9E BE	216	JMP	XRETURN	: not recognized
2235:	217			
2235:20 C6 22	218	BEGIN0	JSR	CHECKFILE
2238:B0 18 2252	219	BCS	ERROR	:Look for VAR file
223A:20 E0 22	220	JSR	OPENFILE	:Get buffer & open file
223D:B0 13 2252	221	BCS	ERROR	
223F:20 F0 22	222	JSR	READFILE	:Read entire file
2242:B0 0E 2252	223	BCS	ERROR	
2244:20 19 23	224	JSR	CLOSEFILE	
2247:20 25 23	225	JSR	SETUP	:Set pointers
224A:20 6D 23	226	JSR	PRINTSIMP	:Print simple variables
224D:20 84 24	227	JSR	PRTARRAY	:Print arrays
2250:18	228	CLC		:Everything OK
2251:60	229	RTS		:That's all, folks
2252:	230			
2252:48	231	ERROR	PHA	:In case of error
2253:20 FB DA	232	JSR	CRDO	
2256:A2 18	233	LDX	##MSG1-MSG0	:Print message
2258:A0 00	234	LDY	#0	
225A:20 7C 22	235	JSR	MESSAGE	
225D:AD 6C BE	236	LDA	VPATH1	:Reprint requested
2260:85 FE	237	STA	PRTPTR	: pathname
2262:AD 6D BE	238	LDA	VPATH1+1	
2265:85 FF	239	STA	PRTPTR+1	
2267:A0 00	240	LDY	#0	
2269:B1 FE	241	LDA	(PRTPTR),Y	
226B:AA	242	TAX		
226C:C8	243	INY		
226D:20 92 22	244	JSR	PRTLOOP	
2270:20 FB DA	245	JSR	CRDO	
2273:20 B0 22	246	JSR	BELL	:Make a ProDOS bell
2276:68	247	PLA		:Recover error code
2277:20 0C BE	248	JSR	PRINTERR	:Let ProDOS print its
227A:18	249	CLC		: error message
227B:60	250	RTS		
227C:	251			
227C: 227C	252	MESSAGE	EQU	*
				:General purpose

```

227C:B9 8D 25      253      LDA MSG0.Y      : message printer
227F:2C 98 BF      254      BIT MACHID      :Check for Apple II+
2282:30 06 228A    255      BMI CHROUT
2284:C9 E0         256      CMP #5E0      :Convert lower case
2286:90 02 228A    257      BCC CHROUT      : to upper case
2288:29 DF         258      AND #11011111 : for II+
228A:20 5C DB      259      JSR OUTDO
228D:C8           260      INY
228E:CA           261      DEX
228F:D0 EB 227C    262      BNE MESSAGE : Uses Y to find char
2291:60           263      RTS           : and X to count length
2292:           264
2292:B1 FE         265      PRTLOOP LDA (PRTPTR).Y :Printer for strings
2294:09 80         266      ORA #580      : or pathname
2296:C9 A0         267      CMP #A0
2298:B0 0E 22A8    268      BCS PRT
229A:48           269      PHA
229B:A9 DB         270      LDA #'[      :Prints control chars
229D:20 5C DB      271      JSR OUTDO      : inside square brackets
22A0:68           272      PLA
22A1:09 40         273      ORA #540
22A3:20 5C DB      274      JSR OUTDO
22A6:A9 DD         275      LDA #' ]
22A8:20 5C DB      276      JSR OUTDO
22AB:C8           277      INY
22AC:CA           278      DEX
22AD:D0 E3 2292    279      BNE PRTLOOP
22AF:60           280      RTS
22B0:           281
22B0:           282      BELL EQU *
22B0:A2 20         283      LDX #520
22B2:A9 02         284      LDA #52 :Pretty ProDOS bell
22B4:20 A8 FC      285      JSR WAIT
22B7:8D 30 C0      286      STA CLICK :Suggested by ProDOS
22BA:A9 24         287      LDA #524 : Tech Ref Manual
22BC:20 A8 FC      288      JSR WAIT
22BF:8D 30 C0      289      STA CLICK
22C2:CA           290      DEX
22C3:D0 ED 22B2    291      BNE BELL1
22C5:60           292      RTS
22C6:           293
22C6:           294      CHECKFILE EQU *
22C6:A9 0A         295      LDA #50A :Ten parameters in
22C8:8D B4 BE      296      STA SSGINFO : parameter list
22CB:A9 C4         297      LDA #GETINFO :Call MLI through
22CD:20 70 BE      298      JSR GOSYSTEM : BASIC.SYSTEM global page
22D0:B0 0D 22DF    299      BCS CHKOUT
22D2:AD B8 BE      300      LDA FIFILID :Check file type
22D5:C9 FD         301      CMP #5FD :VAR file
22D7:D0 03 22DC    302      BNE MISMTCH
22D9:18           303      CLC
22DA:90 03 22DF    304      BCC CHKOUT
22DC:A9 0D         305      LDA #13 :File type mismatch
22DE:38           306      SEC
22DF:60           307      CHKOUT RTS
22E0:           308
22E0:A5 74         309      OPENFILE LDA HIMEM+1 :Use ProDOS temp buffer
22E2:8D CF BE      310      STA OSYSBUF+1 : which is just above
22E5:A9 00         311      LDA #0 : HIMEM
22E7:8D CE BE      312      STA OSYSBUF
22EA:A9 C8         313      LDA #OPEN
22EC:20 70 BE      314      JSR GOSYSTEM
22EF:60           315      OPENRTN RTS
22F0:           316
22F0:           317      READFILE EQU *
22F0:A6 6A         318      LDX VARTAB+1 :Locate data buffer
22F2:E8           319      INX : just above the
22F3:8E D8 BE      320      STX RWDATA+1 : BASIC program, if
22F6:8E 75 25      321      STX BUFFER+1 : there is one, and
22F9:A2 00         322      LDX #0 : starting on a
22FB:8E D7 BE      323      STX RWDATA : page boundary
22FE:8E 74 25      324      STX BUFFER
2301:AD BC BE      325      LDA FIBLOKS
2304:0A           326      ASL
2305:8D DA BE      327      STA RWCOUNT+1
2308:A9 00         328      LDA #0 : twice as many pages
230A:8D D9 BE      329      STA RWCOUNT
230D:AD D0 BE      330      LDA OREFNUM
2310:8D D6 BE      331      STA RWREFNUM :Get file reference number
2313:A9 CA         332      LDA #READ : from OPEN parm list
2315:20 70 BE      333      JSR GOSYSTEM
2318:60           334      RTS
2319:           335
2319:           336      CLOSEFILE EQU *
2319:AD D0 BE      337      LDA OREFNUM :File reference number
231C:8D DE BE      338      STA CREFNUM : from OPEN parm list
231F:A9 CC         339      LDA #CLOSE
2321:20 70 BE      340      JSR GOSYSTEM
2324:60           341      RTS
2325:           342
2325:           343      SETUP EQU *
2325:38           344      SEC
2326:AD B9 BE      345      LDA FIAUXID :Difference between original
2329:E9 05         346      SBC #5 : file load point (FIAUXID)
232B:8D 7A 25      347      STA OFFSET : and present location
232E:AD BA BE      348      LDA FIAUXID+1 : (BUFFER+5) is OFFSET
2331:ED 75 25      349      SBC BUFFER+1 : which will be used to
2334:8D 7B 25      350      STA OFFSET+1 : correct string pointers
2337:           351

```

continued on next page

byte of every address in the internal address table. In either case, the relocation routine adjusts the appropriate byte by adding to it the difference between the program's present location and its final location (RELO).

Once DISPLAY is installed, its operation is relatively simple. If ProDOS receives a command it does not recognize, it transfers program control to DISPLAY. If the command is DISPLAY, then DISPLAY returns control to ProDOS, which interprets the rest of the command (the file name, slot, and drive). ProDOS transfers control back to DISPLAY (at BEGIN0 in line 218 of Listing 1). DISPLAY loads the entire VAR file into memory beginning at a point just above any BASIC program. It will not disturb the program itself, although it may alter its variables. A pointer is set to the beginning of the file and an Applesoft routine is used to move through the file, one variable at a time, printing its name and value. Each time DISPLAY comes to a string variable, it subtracts the OFFSET value from the string pointer to find the address where string characters actually start.

I hope you will find DISPLAY to be a valuable tool in programming the powerful VAR files into your ProDOS programs. It should help both in constructing VAR files and in debugging ProDOS Applesoft programs.

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LISTING 1: DISPLAY (continued)

```

2337:AD 74 25 352 LDA BUFFER ;Put buffer location
233A:85 3C 353 STA AIL ; on zero page
233C:AD 75 25 354 LDA BUFFER+1 ; for indirect addressing
233F:85 3D 355 STA AIL+1
2341: 356
2341:18 357 CLC ;First two bytes in buffer
2342:A9 05 358 LDA #5 ; have the total no of bytes
2344:A0 00 359 LDY #0 ; of simple and array vars--
2346:71 3C 360 ADC (AIL),Y ;Add this number to start of
2348:8D 78 25 361 STA ARRAYEND ; vars (BUFFER+5) to get end
234B:AD 75 25 362 LDA BUFFER+1 ; of array variables
234E:C8 363 INY
234F:71 3C 364 ADC (AIL),Y
2351:8D 79 25 365 STA ARRAYEND+1
2354: 366
2354:18 367 CLC
2355:A9 05 368 LDA #5 ;Third and fourth bytes
2357:C8 369 INY ; in buffer have total
2358:71 3C 370 ADC (AIL),Y ; no of bytes of simple
235A:8D 76 25 371 STA SIMPEND ; vars--add this to
235D:8D 7D 25 372 STA NXTARRY ; the beginning of vars
2360:AD 75 25 373 LDA BUFFER+1 ; to get the end of
2363:C8 374 INY ; simple vars and the
2364:71 3C 375 ADC (AIL),Y ; location of the first
2366:8D 77 25 376 STA SIMPEND+1 ; array variable
2369:8D 7E 25 377 STA NXTARRY+1
236C:60 378 RTS
236D: 379
236D: 236D 380 PRINTSIMP EQU *
236D:A9 05 381 LDA #5 ;Start printing simple
236F:85 FC 382 STA BUFPTR ; variables at BUFFER+5
2371:AD 75 25 383 LDA BUFFER+1
2374:85 FD 384 STA BUFPTR+1
2376:4C D6 23 385 JMP CHKSIMP
2379:A0 00 386 SIMPLOOP LDY #0 ;Clear variable type byte
237B:8C 7C 25 387 STY VARTYPE
237E:B1 FC 388 LDA (BUFPTR),Y ;First char of variable
2380:0A 389 ASL ;Save high bit
2381:2E 7C 25 390 ROL VARTYPE ; in type byte
2384:38 391 SEC
2385:6A 392 ROR ;Set high bit
2386:20 5C 0E 393 JSR OUTDO ;Print char
2389:20 A2 24 394 JSR INCBP ;Point at next char
238C:B1 FC 395 LDA (BUFPTR),Y ;Second char of variable
238E:20 A2 24 396 JSR INCBP ;Point at next byte
2391:0A 397 ASL ;Save high bit of char
2392:2E 7C 25 398 ROL VARTYPE ; in type byte
2395:38 399 SEC ;Set high bit
2396:6A 400 ROR
2397:C9 A0 401 CMP #SA0 ;Check for null or control
2399:80 02 239D 402 BCS OK
239B:A9 A0 403 LDA #SA0 ;If so, replace with space
239D:20 5C DB 404 JSR OUTDO ;Print it
23A0:AC 7C 25 405 LDY VARTYPE ;Use type byte as an index
23A3:B9 81 25 406 LDA VARSYMB,Y ; to print the symbol
23A6:20 5C DB 407 JSR OUTDO ; corresponding to the type
23A9:A2 03 408 LDX #MSG2-MSG1
23AB:A0 18 409 LDY #MSG1-MSG0
23AD:20 7C 22 410 JSR MESSAGE ;Print ' = '
23B0: 411
23B0:AD 5F 25 412 LDA T.SIMPCNT+1 ;Load the stack with
23B3:48 413 PHA ; the SIMPCNT address
23B4:AD 5E 25 414 LDA T.SIMPCNT ; so that control will
23B7:48 415 PHA ; go there after funny JSR
23B8:AD 7C 25 416 LDA VARTYPE ;Use type byte as an
23BB:0A 417 ASL ; index to get the address
23BC:A8 418 TAY ; of the routine which
23BD:B9 63 25 419 LDA SIMPTBL+1,Y ; will print the variable--
23C0:48 420 PHA ;Put the routine's address
23C1:B9 62 25 421 LDA SIMPTBL,Y ; on the stack and call the
23C4:48 422 PHA ; routine by doing an RTS
23C5:60 423 RTS ;Funny JSR
23C6:20 FB DA 424 SIMPCNT JSR CRDO
23C9:18 425 CLC
23CA:A5 FC 426 LDA BUFPTR ;Advance pointer
23CC:69 05 427 ADC #5 ; to the next variable
23CE:85 FC 428 STA BUFPTR
23D0:A5 FD 429 LDA BUFPTR+1
23D2:69 00 430 ADC #0
23D4:85 FD 431 STA BUFPTR+1
23D6: 432
23D6:A5 FD 433 CHKSIMP LDA BUFPTR+1 ;Has the buffer pointer
23D8:CD 77 25 434 CMP SIMPEND+1 ; reached the end of the
23DB:90 9C 2379 435 BCC SIMPLOOP ; simple variables?
23DD:A5 FC 436 LDA BUFPTR
23DF:CD 76 25 437 CMP SIMPEND
23E2:90 95 2379 438 BCC SIMPLOOP ; If not, print another
23E4:60 439 RTS ; If so, return
23E5: 440
23E5: 23E5 441 ARRAYLOOP EQU *
23E5:A0 00 442 LDY #0 ;Clear variable type byte
23E7:8C 7C 25 443 STY VARTYPE
23EA:B1 FC 444 LDA (BUFPTR),Y ;First char of variable
23EC:0A 445 ASL ;Save high bit
23ED:2E 7C 25 446 ROL VARTYPE ; in type byte
23F0:38 447 SEC
23F1:6A 448 ROR ;Set high bit

```

23F2:20 5C DB	449	JSR	OUTDO	:Print char
23F5:C8	450	INY		:Point at next char
23F6:B1 FC	451	LDA	(BUFPTR).Y	:Second char of variable
23F8:0A	452	ASL		:Save high bit of char
23F9:2E 7C 25	453	ROL	VARTYPE	: in type byte
23FC:38	454	SEC		:Set high bit
23FD:6A	455	ROR		
23FE:20 5C DB	456	JSR	OUTDO	:Print char
2401:AC 7C 25	457	LDY	VARTYPE	:Use type bit as an index
2404:F0 06 240C	458	BEQ	PAREN	:No symbol for real array
2406:B9 81 25	459	LDA	VARSYMB.Y	:Get and print symbol
2409:20 5C DB	460	JSR	OUTDO	: corresponding to type
240C:A9 A8	461	LDA	#'	
240E:20 5C DB	462	JSR	OUTDO	
2411:	463			
2411:A0 02	464	LDY	#2	:Update the pointer to
2413:18	465	CLC		: the next array variable
2414:B1 FC	466	LDA	(BUFPTR).Y	: by adding the offset
2416:65 FC	467	ADC	BUFPTR	: stored with this variable
2418:8D 7D 25	468	STA	NXTARRY	
241B:C8	469	INY		
241C:B1 FC	470	LDA	(BUFPTR).Y	
241E:65 FD	471	ADC	BUFPTR+1	
2420:8D 7E 25	472	STA	NXTARRY+1	
2423:C8	473	INY		
2424:B1 FC	474	LDA	(BUFPTR).Y	:Get number of dimensions
2426:8D 7F 25	475	STA	DIM	: for this variable
2429:	476			
2429:18	477	CLC		
242A:A5 FC	478	LDA	BUFPTR	:Move the pointer to
242C:69 04	479	ADC	#4	: the point at which
242E:85 FC	480	STA	BUFPTR	: the dimension sizes
2430:A5 FD	481	LDA	BUFPTR+1	: start
2432:69 00	482	ADC	#0	
2434:85 FD	483	STA	BUFPTR+1	
2436:	484			
2436:AD 7F 25	485	LDA	DIM	:There are two bytes
2439:0A	486	ASL		: for each dimension
243A:8D 80 25	487	STA	DIMPTR	: to hold the size
243D:00 05 2444	488	BNE	PRTDIM	:Branch always
243F:A9 AC	489	LDA	#'	:Print a comma
2441:20 5C DB	490	JSR	OUTDO	: between dimensions
2444:AC 80 25	491	LDY	DIMPTR	:Use dimension pointer
2447:20 F7 24	492	JSR	DIMEN	: as index to print size
244A:CE 80 25	493	DEC	DIMPTR	
244D:CE 80 25	494	DEC	DIMPTR	
2450:D0 ED 243F	495	BNE	DIMLOOP	:Next dimension
2452:A2 04	496	LDX	#MSG3-MSG2	: if there are any left
2454:A0 1B	497	LDY	#MSG2-MSG0	:Print ' ' = ' '
2456:20 7C 22	498	JSR	MESSAGE	
2459:20 FB DA	499	JSR	CRDO	:And carriage return
245C:	500			
245C:AD 7F 25	501	LDA	DIM	:Move the pointer
245F:0A	502	ASL		: to where the data
2460:38	503	SEC		: starts
2461:65 FC	504	ADC	BUFPTR	: (1 + 2 * no of dimen)
2463:85 FC	505	STA	BUFPTR	
2465:A9 00	506	LDA	#0	
2467:65 FD	507	ADC	BUFPTR+1	
2469:85 FD	508	STA	BUFPTR+1	
246B:	509			
246B:AD 61 25	510	LDA	T.ARRYCONT+1	:Load the stack with
246E:48	511	PHA		: the ARRYCONT address
246F:AD 60 25	512	LDA	T.ARRYCONT	: so that control will
2472:48	513	PHA		: go there after funny JSR
2473:AD 7C 25	514	LDA	VARTYPE	:Use type byte as an
2476:0A	515	ASL		: index to get the address
2477:A8	516	TAY		: of the routine which
2478:B9 6B 25	517	LDA	ARRYTBL+1.Y	: will print the variable--
247B:48	518	PHA		:Put the routine's address
247C:B9 6A 25	519	LDA	ARRYTBL.Y	: on the stack and call the
247F:48	520	PHA		: routine by doing an RTS
2480:60	521	RTS		:Funny JSR again
2481:20 FB DA	522	JSR	CRDO	
2484:AD 7E 25	523	LDA	NXTARRY+1	:Has the buffer pointer
2487:CD 79 25	524	CMP	ARRYEND+1	: reached the end of the
248A:90 09 2495	525	BCC	ARRYLOOP	: array variables?
248C:AD 7D 25	526	LDA	NXTARRY	
248F:CD 78 25	527	CMP	ARRYEND	
2492:90 01 2495	528	BCC	ARRYLOOP	:If not, print another
2494:60	529	RTS		:If so, return
2495:	530			
2495:AD 7D 25	531	ARRYLOOP	LDA	NXTARRY
2498:85 FC	532	STA	BUFPTR	:Set up buffer pointer
249A:AD 7E 25	533	LDA	NXTARRY+1	: to point to the next
249D:85 FD	534	STA	BUFPTR+1	: array
249F:4C E5 23	535	JMP	ARRAYLOOP	
24A2:	536			
24A2:E6 FC	537	INCBP	INC	BUFPTR
24A4:D0 02 24A8	538	BNE	INCBP1	:Increment pointer
24A6:E6 FD	539	INC	BUFPTR+1	
24A8:60	540	INCBP1	RTS	
24A9:	541			
24A9:	542	REAL	EQU	*
24A9:A5 FC	543	LDA	BUFPTR	:Transfer buffer pointer
24AB:85 5E	544	STA	INDEX	: to pointer used by
24AD:A5 FD	545	LDA	BUFPTR+1	: move routine
24AF:85 5F	546	STA	INDEX+1	

continued on next page

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ECRITO unit: 11 procs to use easily the text capabilities of the old ADM, the Imagewriter, or even the Scribe thermal-transfer printer.

RECO unit: to read a disk directory or read/write a file at running time.

LORES unit: to plot blocks in 16 colors on the Lo-Res graphics page (full mixed screen), save on disk a Lo-Res picture, print one or two side by side Lo-Res image(s).

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LISTING 1: DISPLAY (continued)

24B1:20 FD EA	547	JSR	MOVFM+4	:Move number to FAC
24B4:20 2E ED	548	JSR	PRNTFAC	:Print value of FAC
24B7:60	549	RTS		
24B8:	24B8 550	STRING	EQU	*
24B8:A0 00	551	LDY	#0	:Get length
24BA:B1 FC	552	LDA	(BUFPTR).Y	: of string
24BC:AA	553	TAX		: and keep in X
24BD:F0 17	24D6 554	BEQ	NULL	:Can't print empty strings
24BF:C8	555	INY		
24C0:38	556	SEC		
24C1:B1 FC	557	LDA	(BUFPTR).Y	:Correct the string pointer
24C3:ED 7A 25	558	SBC	OFFSET	: by subtracting OFFSET
24C6:85 FE	559	STA	PRTPTR	: then store it in PRTPTR
24C8:C8	560	INY		: where the printing
24C9:B1 FC	561	LDA	(BUFPTR).Y	: subroutine can use it
24CB:ED 7B 25	562	SBC	OFFSET+1	
24CE:85 FF	563	STA	PRTPTR+1	
24D0:A0 00	564	LDY	#0	
24D2:20 92 22	565	JSR	PRTLOOP	:Print the string
24D5:60	566	RTS		
24D6:A2 0C	567	LDX	#MSG5-MSG4	:Print message
24D8:A0 32	568	LDY	#MSG4-MSG0	: for empty string
24DA:20 7C 22	569	JSR	MESSAGE	
24DD:60	570	RTS		
24DE:	24DE 571	INTEGER	EQU	*
24DE:A0 00	572	LDY	#0	
24E0:B1 FC	573	LDA	(BUFPTR).Y	:Load integer value
24E2:AA	574	TAX		: into Y and A.
24E3:C8	575	INY		
24E4:B1 FC	576	LDA	(BUFPTR).Y	
24E6:A8	577	TAY		
24E7:8A	578	TXA		
24E8:20 F3 DE	579	JSR	INTOFAC1	:Convert to FP
24EB:20 2E ED	580	JSR	PRNTFAC	:Print FAC
24EE:60	581	RTS		
24EF:	24EF 582	FUNCTION	EQU	*
24EF:A2 13	583	LDX	#MSG4-MSG3	:Function definition is
24F1:A0 1F	584	LDY	#MSG3-MSG0	: not stored in a VAR file--
24F3:20 7C 22	585	JSR	MESSAGE	:Print a message instead of
24F6:60	586	RTS		: the definition
24F7:	24F7 587			
24F7:B1 FC	588	DIMEN	EQU	*
24F9:AA	589	LDA	(BUFPTR).Y	:Load dimension
24FA:88	590	TAX		: size
24FB:B1 FC	591	DEY		
24FD:CA	592	LDA	(BUFPTR).Y	
24FE:00 FF	593	DEX		:Dimension size must
2500:D0 03	594	CPX	#\$FF	: be decremented before
2502:38	595	BNE	DIMEN1	: printing
2503:E9 01	596	SEC		
2505:20 24 ED	597	SBC	#1	
2508:60	598	DIMEN1	JSR	LINPRT
2509:	599	RTS		
2509:20 A9 24	600			
250C:20 FB DA	601	REALARRY	JSR	REAL
250F:A9 05	602	JSR	CRDO	:Print a real number
2511:20 33 25	603	LDA	#5	: and a carriage return
2514:90 F3	2509 604	JSR	NXTLMNT	:Advance 5 bytes to get
2516:60	605	BCC	REALARRY	: the next number
2517:	606	RTS		:Do it again if any are left
2517:20 B8 24	607			
251A:20 FB DA	608	STRARRY	JSR	STRING
251D:A9 03	609	JSR	CRDO	:Print a string
251F:20 33 25	610	LDA	#3	: and a carriage return
2522:90 F3	611	JSR	NXTLMNT	:Advance 3 bytes to get
2524:60	612	BCC	STRARRY	: the next string
2525:	613	RTS		:Do it again if any are left
2525:20 DE 24	614			
2528:20 FB DA	615	INTARRY	JSR	INTEGER
252B:A9 02	616	JSR	CRDO	:Print an integer
252D:20 33 25	617	LDA	#2	: and a carriage return
2530:90 F3	618	JSR	NXTLMNT	:Advance 2 bytes to get
2532:60	619	BCC	INTARRY	: the next number
2533:	620	RTS		:Do it again if any are left
2533:18	621			
2534:65 FC	622	NXTLMNT	CLC	
2536:85 FC	623	ADC	BUFPTR	:Add the contents of A
2538:A9 00	624	STA	BUFPTR	: to the buffer pointer
253A:65 FD	625	LDA	#0	
253C:85 FD	626	ADC	BUFPTR+1	
253E:	627	STA	BUFPTR+1	
253E:AD 00 C0	628			
2541:10 0B	254E 629	LDA	KBD	:Check the keyboard for keys
2543:8D 10 C0	630	BPL	NXTLMNT0	: that abort array printing
2546:C9 83	631	STA	KBSTROBE	
2548:F0 10	255A 632	CMP	#\$83	:Cntrl-C
254A:C9 9B	633	BEQ	NXTLMNT1	
254C:F0 0C	255A 634	CMP	#\$9B	:Escape
254E:	635	BEQ	NXTLMNT1	
254E:A5 FD	636			
2550:CD 7E 25	637	NXTLMNT0	LDA	BUFPTR+1
2553:90 05	255A 638	CMP	NXTARRY+1	:Has buffer pointer reached
2555:A5 FC	639	BCC	NXTLMNT1	: the next array?
2557:CD 7D 25	640	LDA	BUFPTR	
255A:60	641	CMP	NXTARRY	
255B:	642	RTS		:Carry set if so
255B:00	643			
	644	DB	0	:Tell relocater table follows

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CIRCLE NUMBER 39

```

255C: 645 ;
255C: 255C 646 ATBL EQU * ;Internal addresses
255C:35 22 647 T.BEGIN0 DW BEGIN0
255E:C5 23 648 T.SIMPCONT DW SIMPCONT-1
2560:80 24 649 T.ARRYCONT DW ARRYCONT-1
2562:A8 24 650 SIMPTBL DW REAL-1,STRING-1,FUNCTION-1,INTEGER-1
2564:B7 24
2566:EE 24
2568:DD 24
256A:08 25 651 ARRYTBL DW REALARRY-1,STRARRY-1,BELL-1,INTARRY-1
256C:16 25
256E:AF 22
2570:24 25
2572:00 00 652 ; DW 0 ;Tells the relocater to quit
2574: 653 ;
2574: 0002 654 BUFFER DS 2 ;Start of main data buffer
2576: 0002 655 SIMPEND DS 2 ;End of simple vars--
2578: 656 ; start of arrays
2578: 0002 657 ARRYEND DS 2 ;End of arrays--
257A: 658 ; start of string values
257A: 0002 659 OFFSET DS 2 ;Correction for
257C: 660 ; string pointers
257C: 0001 661 VARTYPE DS 1 ;Type of variable (0-3)
257D: 662 ; real,string,funct,int
257D: 0002 663 NXTARRY DS 2 ;Beginning of array
257F: 664 ; after the current one
257F: 0001 665 DIM DS 1 ;Number of dimensions
2580: 666 ; in array
2580: 0001 667 DIMPTR DS 1 ;Pointer to print size
2581: 668 ; of each dimension
2581:A0 A4 A0 A5 669 VARSYMB ASC . $ % ;Symbols for
2585: 670 ; the four variable types
2585:07 C4 C9 D3 671 CMD STR 'DISPLAY'
2589:D0 CC C1 D9
258D:D5 EE E1 E2 672 MSG0 ASC 'Unable to read the file '
2591:EC E5 A0 F4
2595:EF A0 F2 E5
2599:E1 E4 A0 F4
259D:E8 E5 A0 E6
25A1:E9 EC E5 A0
25A5:A0 BD A0 673 MSG1 ASC ' = '
25A8:A9 A0 BD A0 674 MSG2 ASC ' ) = '
25AC:C6 F5 EE E3 675 MSG3 ASC 'Function definition'
25B0:F4 E9 EF EE
25B4:A0 E4 E5 E6
25B8:E9 EE E9 F4
25BC:E9 EF EE
25BF:C5 ED F0 F4 676 MSG4 ASC 'Empty string'
25C3:F9 A0 F3 F4
25C7:F2 E9 EE E7
25CB: 25CB 677 MSG5 EQU *
25CB: 25CB 678 LAST EQU *
25CB: 679 ;,ype of variable (0-3)
257D: 662 ; real,string,funct,int
257D: 0002 663 NXTARRY DS 2 ;Beginning of array
257F: 664 ; after the current one
257F: 0001 665 DIM DS 1 ;Number of dimensions
2580: 666 ; in array
2580: 0001 667 DIMPTR DS 1 ;Pointer to print size
2581: 668 ; of each dimension
2581:A0 A4 A0 A5 669 VARSYMB ASC . $ % ;Symbols for
2585: 670 ; the four variable types
2585:07 C4 C9 D3 671 CMD STR 'DISPLAY'
2589:D0 CC C1 D9
258D:D5 EE E1 E2 672 MSG0 ASC 'Unable to read the file '
2591:EC E5 A0 F4
2595:EF A0 F2 E5
2599:E1 E4 A0 F4
259D:E8 E5 A0 E6
25A1:E9 EC E5 A0
25A5:A0 BD A0 673 MSG1 ASC ' = '
25A8:A9 A0 BD A0 674 MSG2 ASC ' ) = '
25AC:C6 F5 EE E3 675 MSG3 ASC 'Function definition'
25B0:F4 E9 EF EE
25B4:A0 E4 E5 E6
25B8:E9 EE E9 F4
25BC:E9 EF EE
25BF:C5 ED F0 F4 676 MSG4 ASC 'Empty string'
25C3:F9 A0 F3 F4
25C7:F2 E9 EE E7
25CB: 25CB 677 MSG5 EQU *
25CB: 25CB 678 LAST EQU *
25CB: 679 ;

```

END OF LISTING 1

KEY PERFECT 5.0 RUN ON DISPLAY					
CODE-5.0	ADDR#	- ADDR#	CODE-4.0		
1CB5052D	2000	- 204F	275D	105721A0	2230 - 227F
E661E459	2050	- 209F	2766	B670BC7D	2280 - 22CF
936EC55D	20A0	- 20EF	29D1	7AE85E1D	22D0 - 231F
C6CA3035	20F0	- 213F	28B6	54D9FE72	2320 - 236F
7E74B548	2140	- 218F	2321	C1139482	2370 - 23BF
054BD459	2190	- 21DF	21C3	6FC52FBB	23C0 - 240F
C3BEA3A1	21E0	- 222F	25C3	821A0405	2410 - 245F
				3156FEF0	2460 - 24AF
				4113E97D	24B0 - 24FF
				8D80DEE8	2500 - 254F
				A7FB1300	2550 - 259F
				EC3AD910	25A0 - 25CA
				24841B0E	= PROGRAM TOTAL =
					2B80
					2A0F
					2769
					299D
					2932
					2AE9
					2711
					29EA
					2615
					24E7
					2AF3
					164F
					05CB



Reviewed by John DiPrete

Baron

With \$35,000 in hand, could you become a real estate baron? This simulation challenges you to master the world of buying and selling land. In Baron, you negotiate second mortgages, put together creative financing, buy residential and business properties and speculate on land. The 37-page manual offers directions on how to play, a general introduction to real estate, helpful hints, a quick reference section, loading instructions, a glossary and an index.

You start the game with \$35,000 in seed money. If you earn \$1,000,000 in five years (accelerated in computer time), you achieve Baron status. Other ranks to shoot for are Investor (\$100,000) and Broker (\$250,000). You can save and restore a game or generate a new game each time you play, and record up to 14 previous scores. You view newspaper headlines and study charts to make investment decisions, and advance the date at monthly intervals. Monthly readouts over the five-year span reveal your capital investment outcome.

Success in the world of Baron may not guarantee similar success in the real world, but the game's portrayal of real estate transactions should give future investors a sense of what goes on. I found the experience of investing to be fascinating, but I don't recommend the program for the mathematically squeamish. You must be able to foresee trends, stay calm and patient, and master an abundance of raw data. It takes plenty of concentrated effort to master Baron.

The principal task of Baron — reading and comparing a wealth

of financial data on many different charts — requires selecting from various menus, zooming in to a screen to view a chart, switching to another screen, selecting another chart to study and so on. The program responds to your keyboard input promptly, making elaborate cross-checking of information both easy and convenient.

I recommend this game to professional people or business students who are serious, painstaking and love to work for their fun.

Baron, Blue Chip Software, 6740 Eton Ave., Canoga Park, CA 91303. Type of game: Real estate simulation. Originality: Above average. Input: Keyboard. Price: \$39.95.

I, Damiano

The time and place: fourteenth century Europe. The premise: You are a wizard in search of the Sacred Stone. It has the power to ward off the evil Pardo, whose armies threaten to ravage your home city of Partestrada.

As in most typical adventure games, you must solve a variety of problems to achieve your goal. You type in commands, and the computer screen reveals the outcomes of your decisions in both text and graphics. The pictures and narration appear side by side, with the graphics occupying about a third of the screen. (By the way, the screen illustrations depicted on the program package are proportionately larger than the actual screen displays.) The colorful screen imagery is adequate, but generally fuzzy looking. The text offers a vivid description of events and scenarios, but tends, at times, to be verbose.

Since you die quite easily in this game, I found the save-and-

John DiPrete, 45 Vale Ave., Cranston, RI 02910



Whether you like arcade action, educational fun, or stimulating simulations, you'll appreciate these capsule reviews of seven new games.

USER VIEWS

restore feature especially useful. Typing SAVE at frequent intervals during your adventures allows you to reenter at an advanced point in the story, should you be suddenly struck down.

Based on the fantasy trilogy written by R.A. MacAvoy, the adventure includes several characters besides Damiano — the witch, Saara; an archangel named Raphael; your faithful mutt, Macchiata; and Beelzebub. The object of the game is to achieve your goal through peaceful means. If your actions are too evil or aggressive, your good-evil soul index (displayed on the screen) will reflect this. Alas, if you behave too badly, the Evil One may claim you! In this manner, I, Damiano tends to discourage you from doing wrong — a nice touch.

Nevertheless, the satanic elements in this adventure (Lucifer, himself, plays a dominant role) will be unwelcome to the growing number of critics of games like Dungeons and Dragons. In addition, I'm sure that many who play this game will object to passages like the text that describes creatures that "drink blood through the corpses' mouths."

I have other reservations about this program. The program often prints identical responses to the player's separate, dissimilar actions. As a result, illogical events occur. For instance, when I met the hut keeper and he asked me who I was, I told him. Later, I punched him, and he knocked me out. As I awoke and tried to leave, he again asked me who I was. Was he forgetful? A nerd? Or what?

Better games of this type exist. I generally prefer picture-and-text adventures to text-only formats, but found I, Damiano weak in both areas. Its imagery is compressed and fuzzy, and its text is illogical and occasionally gruesome. I'd rate this one a C, at best.

I, Damiano, Bantam Software, 666 Fifth Ave., New York, NY 10103.

Type of game: Adventure. Originality: Below average. Input: Keyboard. Price: \$39.95.

Station Five

Station Five consists of four different arcade scenarios. Faced with a meteor storm, you must direct your robot, Hoofer, to save your lunar station by completing four separate tasks: beefing up the nuclear generators, building transmission towers, transporting you to the Orbiting Relay Station and supplying power to the Earth. You play against the computer at three difficulty levels using the joystick or keyboard to control Hoofer. (I preferred joystick control.)

In the first scenario, you move Hoofer on a grid of 32 squares, jumping to avoid falling meteors and tossing dead meteors into a slot to empower the particle shield. Hoofer must open and close vents to keep your reactors operating at peak efficiency — if too many are closed at one time, you blow up! The second scenario is played on another grid in a dodge-and-gather mission. In this scene, Hoofer must collect hammers (an act that automatically erects the transmission towers in the background), while simultaneously eluding "homers" and neutralizers.

In the third scenario, the pattern of jumping movement (on another 32-square grid) resembles Q-Bert's movement in the arcade game of the same name. Hoofer must jump on each Off switch to activate the transporter. But jumping on the On switches turns them off! It's an odd, invigorating setup. In the last scenario, Hoofer must collect spare parts and float or bounce toward various space platforms, while avoiding fast-moving, free-floating hazards. The arcade game Joust immediately jumps to mind.

To sum up: the detailed graphics and animation in these four-games-in-one make an interesting, fast-paced arcade experience. As for its novelty, you've already seen similar action in games like Donkey Kong, Q-Bert, Joust and others. Station Five continues a successful (though somewhat fading) tradition.

Station Five, MicroLab, Inc., 2699 Skokie Valley Rd., Highland Park, IL 60035. Type of game: Arcade. Originality: Moderate. Input: Joystick or keyboard. Price: \$20.00.

Wishbringer

Interactive fiction, the relatively recent concept of involving participants directly in the plot of a story, has mushroomed into a growing number of books, games and computer programs. Wishbringer, another adventure game in the Infocom series of interactive fiction, is on a par with other Infocom classics such as the Zork series, Suspended, Starcross, Sorcerer and The Hitchhiker's Guide to the Galaxy.

The program responds to your keyboard commands. Like other Infocom adventure games, Wishbringer has a full-sentence parser. It interprets your keyboard commands with a vocabulary exceeding 1,000 words.

You start as a postal clerk on a simple errand, then find yourself in a world of magic, mayhem and mystery. To find a lost cat, you must solve puzzles, hoodwink creepies and figure out the best paths. 'Tain't easy! Patience, resolve and cleverness are essential.

One key to victory is in manipulating objects you find along your journey. You must decide what to take and what to leave behind. One fabulous little item, the Wishing-stone, enables you to cast spells (under proper conditions) for such things as good fortune, seeing ahead, camouflage, escape — and even rain. Packaged with the game disk is a real Wishing-stone, a small white rock that glows

in the dark. Nice touch, Infocom people.

You may want to play this adventure game with a friend since two heads may be necessary to solve some of the knottier dilemmas. The game may take several days or weeks to solve, and you can save a game in progress on disk.

Wishbringer, Infocom, Inc., 125 Cambridge Park Dr., Cambridge, MA 02140. Type of game: Interactive fiction (fantasy), introductory level. Originality: Moderate. Input: Keyboard. Price: \$39.95.

Felony!

The graphics, hint booklet, crime manual, and other paraphernalia associated with Felony! resemble another fine mystery game from CBS Software, Murder by the Dozen (reviewed in Vol. 5/No. 10).

You must solve a crime by traveling around, interviewing witnesses and suspects, hunting for clues, taking notes and forming conclusions. Collecting raw data and tying it together isn't easy — but it's fun! You must use logic and deduction to form hypotheses and test them.

Up to four people can play. The player who completes his or her investigatory task quickest is awarded the next turn. When the case has been solved, players are awarded sleuth ratings. There are 12 ratings, ranging from Clairvoyant Cop to Total Turkey. Felony! includes 12 crime cases, all at the same level of complexity.

The way both Felony! and its companion game, Murder by the Dozen, are played resembles the board classic, Clue!, except that playing on a computer greatly enhances the enjoyment. The key to winning? Take copious notes, rely on your reasoning powers, and most vital of all, consult the lab frequently for analyses of the physical evidence you've gathered.

If you'd like to be Lieutenant Columbo, temporarily at least, buy Felony!

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Felony!, CBS Software, One Fawcett Pl., Greenwich, CT 06836.
Type of game: Mystery whodunit. Originality: Moderate. Input: Keyboard. Price: \$24.95.

SunDog

The outstanding graphics in this adventure game deserve galactic applause. Sharp, realistic pictures of space ship features, aerial and ground views, and cities and planet systems, along with excellent close-up views, give SunDog a very sophisticated look.

At the start of each game, you must choose character traits for your hero: varying portions of intelligence, charisma, luck, strength and dexterity. Then, after setting off aboard your star freighter, you must eventually build a colony, locate frozen colonists, shoot down space hazards, trade and bargain for goods, and much more. You have a choice of wide-ranging scenarios, each with a different setup, rules and goals. You play against the Apple, and can save up to four games in progress on disk.

This isn't just another adventure game. Perhaps SunDog's finest feature is the number of different perspectives offered during the game. A player must employ a variety of distinct, creative coping skills to succeed. You can assume the role of navigator, piloting your ship and fighting off other ships; you can play a shoot-'em-up game on the ground or in space; you can become a financial investor and wheeler-dealer — and best of all, you can solve problems. Exciting and diverse elements make this a fantastic action/strategy adventure.

SunDog, FTL Games, 7907 Ostrow St., Suite F, San Diego, CA 92111. Type of game: Adventure. Originality: Moderate. Input: Two-button joystick. Price: \$39.95.

Willy Byte in the Digital Dimension

Willy Byte in the Digital Dimension is an instructional arcade game that guides you through the major parts of your computer: the central processing unit, keyboard, RAM, disk drive, power source and clock. During the colorful journey, you learn about such concepts as flowcharting and how the computer works.

Using a joystick or the keyboard, you control the character Willy Byte, moving him in four directions and making him jump, pick up or discard a tool, and stop. Willy must perform several duties while avoiding the hazards of the evil Hex Luthor. Each new section offers a different scenario, with novel tasks and dangers.

The game features good graphics and nice animation, but jumping around obstacles is nothing new for the arcade veteran. You play against the Apple, and the difficulty level depends on the length of your initial message, which you must send through the various sections.

The emphasis on learning turns this game into hard work. The teaching approach seems contrived — as if to spoil one's fun. Cartoon characters can be effective aids in teaching basic concepts like the alphabet (a good example is the Charlie Brown gang in the Peanuts learning series from Random House Software). However, the Willy Byte character seems totally incongruous for introducing concepts like the relationship between an ASCII character, its hexadecimal code and its binary representation. The sprite-like Willy Byte doesn't make the material easier to digest. Quite simply, Willy just gets in the way.

Willy Byte in the Digital Dimension, Data Trek Inc., 621 Second St., Encinitas, CA 92024. Type of game: Instructional arcade. Originality: Moderate. Input: Joystick or keyboard. Price: \$39.95.



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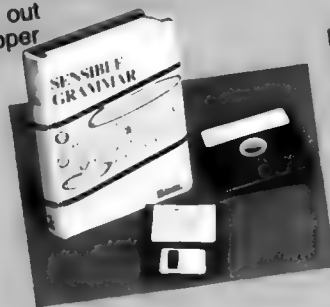
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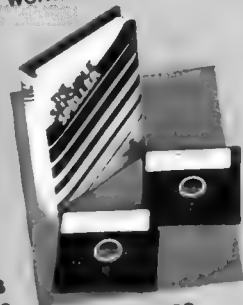
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PART V FIRST COUSINS ONCE REMOVED

NIBBLING AT ASSEMBLY LANGUAGE

by S. Scott Zimmerman

Learn about
65C02 addressing modes and how to use them. Sample programs demonstrate implementing arrays, printing messages to the screen, using ROM routines, and using the ampersand vector.

The annual Zimmerman reunion brings together a large collection of closely-related people with a common goal — to bore each other. Along with boredom, I have the problem of trying to remember names. I can barely remember the names of my own seven children, let alone the names of my brother's and sister's kids, my cousins' kids, and my aunt's cousin's daughter's kids.

Computer programs can be much like a family reunion, with long, boring lists of data and names of variables. Like kids at the reunion, variables are difficult to manage, and their names are easy to forget.

But programmers know the secret to keeping track of closely-related data: arrays. Take, for example, the program RAIN.BASIC (Listing 1). Type the program in and SAVE it to disk with:

SAVE RAIN.BASIC

When you run the program, 18 raindrops fall from the top of the screen to the bottom. This simple program illustrates the use of arrays. The program keeps track of the locations of 18 raindrops and moves them down the screen, using three one-dimensional arrays. (Alternatively, the pro-

gram could have used one three-dimensional array.)

The program initializes the XR and YR arrays in **line 110** by reading the data found in **line 190**, and it plots the raindrops in their initial locations. **Lines 120-170** form the main program loop, in which raindrops move down the screen. The program uses the RF (rain flag) array to determine if a raindrop is still on the screen. Once a raindrop falls below position YR = 159 (see **line 150**), the program erases it from the screen and decrements the raindrop counter, N. The program ends when N reaches zero, indicating that no raindrops remain on the screen.

ASSEMBLY LANGUAGE ARRAYS

Even with little programming experience, you can grasp the usefulness of arrays by analyzing RAIN.BASIC. Arrays in machine language are just as important.

To illustrate arrays in machine language, I have written RAIN.ML, the machine language version of RAIN.BASIC (Listing 2). Key the source program into your assembler, assemble the program, and save the object code as RAIN.ML. To run the program, type:

BRUN RAIN.ML

or type:

BLOAD RAIN.ML

followed by:

CALL 16384

I will explain the program in detail later, but first, let's look at **lines 40-47**, in which the array RAINFLAG is initialized to zero. Initialization of arrays is often unnecessary in BASIC, since all variables, including arrays, are automatically set to zero when you RUN a program. But the contents of the region of memory designated for the RAINFLAG array in the machine language program are unknown, and therefore you must initialize the array values explicitly.

To initialize the array RF() to zero in BASIC, you would write:

FOR I=1 TO N: RF(I) = 0: NEXT I

where N is the number of elements in the array and I is the index. RAIN.ML, on the other hand, uses the X-Register as the index. The program sets the X-Register to NUMDOTS in **line 43**. In Part IV of this series (Vol. 6/No. 11) machine language programs were used to execute loops in reverse order, starting at the highest index value (in this case, NUMDOTS) and proceeding down to zero. In **line 44**, the program sets the Accumulator to zero, and the loop actually begins in **line 45**.

Here is the key point: In **line 45** the command STA RAINFLAG,X stores the contents of the Accumulator into RAINFLAG plus X, not into RAINFLAG (\$40DB). If

by S. Scott Zimmerman, 1129 East 470 North, Orem, UT 84057. The programs run under DOS 3.3 and ProDOS.

the X-Register happens to contain two, for example, then RAINFLAG,X represents the address \$40DB+2, or \$40DD. In this case, the X-Register is an index; in fact, the X-Register is often called the X index register. The operand, RAINFLAG,X, specifies the memory location of element X of the RAINFLAG array.

ADDRESSING MODES

The command STA RAINFLAG,X is an example of the absolute indexed addressing mode. An addressing mode is the way that an instruction (such as LDA, STA, LDY, or STY) addresses memory.

If you have followed the Nibbling at Assembly Language series, you have already used several different addressing modes. Consider the following uses of the LDA (Load Accumulator) instructions:

LDA #10 ;Load value 10 (\$0A) into Accumulator
LDA YVAL ;Load value found at YVAL

The command LDA #10 is an example of the *immediate* addressing mode. The Accumulator is loaded with the byte value (in this case 10 or \$0A), which immediately follows the opcode in memory. The object code for LDA #10 is A9 0A.

The command LDA YVAL (see line 86 of Listing 2) is an example of the absolute addressing mode. The Accumulator is loaded with the byte value currently at address YVAL. Since the address of YVAL is \$40B6 in RAIN.ML, LDA YVAL loads the Accumulator with the byte value currently stored at \$40B6. The object code for LDA YVAL is AD B6 40. This is called the absolute addressing mode because the operand address is used without modification. As you will see with other addressing modes, the operand may indicate a relative address, or it may indicate where to find another address.

Table 1 lists the addressing modes available with the 65C02 microprocessor (used in the //c and enhanced //e). Except where noted, the syntax is the same for the 6502 microprocessor (used in the II Plus and //e). I will not discuss all of these addressing modes at this time, but will cover them as needed throughout the series.

Not all of these addressing modes can be used by all of the opcodes. For instance, LDA can use immediate, absolute, zero page, absolute indexed by X or Y, zero page indexed by X or Y, indirect indexed, indexed indirect and zero page indirect addressing modes, while BNE uses only relative addressing mode. For a complete list of opcodes with their allowed addressing modes, consult your *Apple II Reference Manual*.

COMPARING THE LISTINGS

By comparing RAIN.BASIC (Listing 1) and RAIN.ML (Listing 2), you can readily see some of the differences between BASIC and assembly language. Although the assembly

source code listing is much longer, the object code (the machine language program) is only 273 bytes, compared to 347 bytes for the BASIC program (excluding the REM statements in lines 10-80). In addition, RAIN.BASIC uses 20 bytes for simple variables and 307 bytes for arrays, whereas the machine language program uses no additional bytes for variables and arrays. The total memory requirements are 674 bytes for the BASIC program and 273 bytes for the machine language program.

RAIN.ML not only uses less memory, but, as you would expect, it is much faster: RAIN.BASIC takes 93.7 seconds to run, while RAIN.ML takes only 2.3 seconds. Although programming in assembly language is more difficult than in BASIC, your efforts are rewarded by faster, more compact programs.

HOW RAIN.ML WORKS

RAIN.ML demonstrates the use of arrays and several addressing modes. The array containing the initial X,Y coordinate values of raindrops is called XYSTART (lines 128-131 of Listing 2). Lines 51-70 plot the raindrops in their initial locations on the Hi-Res screen (analogous to line 140 of RAIN.BASIC). Line 51 initializes the loop index to zero, using the immediate addressing mode to load the X-Register. The array index, which in this case is different from the loop index, is set to zero in line 52, again using the immediate addressing mode.

The loop that plots the raindrops starts in line 53. The values of the loop and array indexes are stored in locations LOOPINDX and ARRINDX, using the absolute addressing mode. The initial X-coordinate of the current raindrop is loaded into the Accumulator in line 55, using the absolute indexed addressing mode. For example, when the loop index is zero, element 0 of the

XYSTART array, located at \$40ED, is accessed; when the loop index is one, element 1 of the XYSTART array, located at \$40EE, is accessed; and so forth.

Note that in assembly language, you nearly always use the zeroth element of an array. Even though element 0 in BASIC and Pascal arrays nearly always exists, it is seldom actually used.

Line 56 of RAIN.ML stores the X-coordinate from the XYSTART array into the XRAIN array, whose index is located in the Y-Register. This is another example of the absolute indexed addressing mode, but this time using the Y-Register as the index.

Line 57 saves the X-coordinate in the variable XVAL, using the absolute addressing mode. The INX instruction in line 58 increments the X-Register (which contains the loop index), using the *implied* addressing mode. As the name indicates, the operand (X, in this case) is implied in the instruction itself.

Line 59 saves the new X-value in LOOPINDX, using the absolute addressing mode. Lines 60 and 61 transfer the initial Y-coordinate value from the XYSTART array to the YRAIN array, using absolute indexed addressing modes.

Line 62 uses the absolute addressing mode to load the X-Register with XVAL, and line 63 uses the immediate addressing mode to load the Y-Register with zero. Line 64 uses the Applesoft ROM routine, HPLLOT, to plot a point on the Hi-Res screen at the location indicated by the contents of the Accumulator and the X and Y Registers. I will explain this in more detail later in the USING ROM section.

After plotting a dot (line 64), the program restores the loop index and the array index into the X and Y Registers, respectively (see lines 65 and 66). Lines 67 and 68 increment these two indexes, and then line 69 checks to see if the Y-Register (the array

TABLE 1: 65C02 Addressing Modes

Addressing Mode	Example Syntax	Example Object Code
Immediate	LDA #1F	A9 1F
Absolute	LDA \$6AD5	AD D5 6A
Zero page	LDA 1F	A5 1F
Accumulator	ASL	0A
Implied	INX	E8
Absolute indexed, X	LDA \$6AD5,X	BD D5 6A
Absolute indexed, Y	LDA \$6AD5,Y	B9 D5 6A
Zero page indexed, X	LDA 1F,X	B5 1F
Zero page indexed, Y	LDX 1F,Y	B6 1F
Indirect indexed	LDA (1F),Y	B1 1F
Indexed indirect	LDA (1F,X)	A1 1F
Relative	BNE 1F	D0 1F
Indirect	JMP (\$6AD5)	6C D5 6A
Zero page indirect*	LDA (1F)	B2 1F

*Not available on the 6502

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index) has reached NUMDOTS, the number of dots. If not, line 70 makes the program branch back to PLOTLOOP in line 53.

You should be able to understand the assembly language code in lines 74-113 of Listing 2.

ALLOCATING MEMORY

When writing a BASIC program, you seldom need to worry about how your program variables and arrays use memory. The BASIC interpreter sets up the memory locations automatically. However, when you program in assembly language, you must specify the memory location of all variables and arrays. Thus, in lines 119-127 of Listing 2, RAIN.ML contains statements that reserve regions of memory for the variables NUMDOTS, NDOTSON, LOOPINDX, and so on. For example:

RAINFLAG DFS 18

The command DFS is an assembler directive (or pseudo-opcode) that tells the assembler to define storage (DFS), for example, to reserve 18 bytes of memory. The address \$40DB at the start of the memory region (not actually included in Listing 2), becomes equated to the label RAINFLAG.

If you want to initialize an array to a set of values in BASIC, you usually use a DATA statement to store the initial array data. In assembly language, you use an assembler directive or pseudo-opcode that lets you put numbers directly into your object code. One way to do this is with the DFC (define constant) assembler directive, as shown in lines 128-131 of Listing 2. Some assemblers use a different pseudo-opcode name, such as DFB (define byte) or DC (define constant). Read your assembler's manual for the correct pseudo-op name and an explanation of how to use it.

USING ROM ROUTINES IN ASSEMBLY LANGUAGE

Your Apple's ROM is full of wonderful machine language subroutines. Without them, most short, simple assembly language programs would be enormous.

RAIN.ML makes liberal use of ROM routines. For example, the routine to clear the text screen — the Applesoft HOME command — is located in ROM at address \$FC58. The routine to clear and initialize Hi-Res page 1 — the Applesoft HGR command — is located in ROM at address \$F3E2. These two routines are simple to use in assembly language. You just have to EQUate an appropriate name (e.g., HOME and HGR) to the address of the routine (see lines 19-23 in Listing 2), and then call the routines with a JSR (see lines 30-31). That's all there is to it.

Other ROM routines are not so simple. They expect to find data in certain 65C02 registers. For example, the SETHCOL routine sets HCOLOR for the points you subsequently plot on the Hi-Res screen. Before

doing a JSR to SETHCOLOR (at \$F6EC), the desired color code (0-7) must be present in the X-Register (see lines 32-33 in Listing 2).

A still more complicated ROM routine is HPLOT, found at \$F457 (see lines 20, 87 and 103 of Listing 2). HPLOT requires that the program specify the horizontal (or X-coordinate) and the vertical (or Y-coordinate) of the point to be plotted. This is actually not very difficult.

The X-coordinate can have a value from 0 to 279 (\$00 to \$117), and therefore requires two bytes. The program must load the low-order byte (LOB) value of the horizontal coordinate into the X-Register (line 84 of Listing 2), and the high-order byte (HOB) into the Y-Register (line 85).

Since the Y-coordinate can only have a value from 0 to 191 (\$00 to \$BF), it requires only one byte. The program must load the byte value of the vertical position into the Accumulator. Once the horizontal and vertical values are in the 65C02 internal registers, the program does a JSR to HPLOT (\$F457) to turn on the desired pixel.

ROM INFORMATION SOURCES

Many Nibble readers have written to me with the question, "How do I find out what ROM routines are available and how do I learn how to use them?" There are five major sources of information about ROM:

1. Many programs in Nibble are written in assembly language, and most of these contain Applesoft ROM or Monitor ROM references. An excellent way to learn more is to study the source code

and read the explanations in these articles. More particularly, the Disassembly Lines series by Sandy Mossberg explains the ROM routines in depth. And, of course, Nibbling At Assembly Language will include future examples of ROM routines.

2. *All About Applesoft* is a must for all serious assembly language programmers. It is published by A.P.P.L.E. (Apple PugetSound Program Library Exchange), 290 S.W. 43rd Street, Renton, WA 98055. It contains detailed explanations of many Applesoft ROM routines.
3. Another valuable tool for assembly language programmers is the book *Apple II Monitors Peeled* published by Apple Computer, Inc., 10260 Brandley Drive, Cupertino, CA 95014. It contains explanations of numerous Monitor ROM routines and shows how to access them from assembly language programs.
4. Apple also publishes the *Apple II Reference Manual* and *Reference Manual Addendum: Monitor ROM Listings*. If you have them on your bookshelf, dust them off and look them over!
5. Finally, I recommend *What's Where in the Apple* by William F. Luebbert, published by Micro Ink, Inc., P.O. Box 6502, Chelmsford, MA 01824. This book lists all the Applesoft and Monitor ROM routines, although the explanations of how to use them are often too brief to be of solid value.

In addition to these resources, you may want to consult other texts on Apple assembly language.

Nibble Light Pen, ProDOS Directory List, ProCursor, DISPLAY and programs from Nibbling at Assembly Language V are available on diskette for an introductory price of \$17.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: RAIN.BASIC

```

10 REM *****
20 REM *      RAIN.BASIC      *
30 REM * BY SCOTT ZIMMERMAN *
40 REM * COPYRIGHT (C) 1986 *
50 REM * By MICROSPARC, Inc *
60 REM * CONCORD, MA 01742 *
70 REM *****
80 REM
90 HOME : HGR : HCOLOR= 3
100 N = 18:M = N: DIM XR(N),YR(N),RF(N)
110 FOR I = 1 TO N: READ XR(I),YR(I): HPLLOT
    XR(I),YR(I): NEXT I
120 FOR I = 1 TO M
130 IF RF(I) THEN 170
140 HCOLOR= 0: HPLLOT XR(I),YR(I): HCOLOR= 3
150 YR(I) = YR(I) + 1: IF YR(I) > 159 THEN RF
    (I) = 1:N = N - 1: ON N = 0 GOTO 180: GOTO
    170
160 HPLLOT XR(I),YR(I)
170 NEXT I: GOTO 120
180 TEXT : HOME : END
190 DATA 22,0,28,18,224,5,56,3,182,24,238,17
    ,210,20,112,14,196,14,140,42,154,5,168,2
    ,70,10,126,16,98,4,17,10,84,21,252,0

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END OF LISTING 1

continued on page 99

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CIRCLE NUMBER 43

ENTERING MSG.PRINT

Now let's look at a short example showing more uses of the indirect indexed addressing mode and new ROM routines. MSG.PRINT demonstrates message printing from your assembly language program.

Key MSG.PRINT (Listing 3) into your assembler, assemble the program, and save both the source code and object code (MSG.PRINT) to disk.

To execute MSG.PRINT, first make sure you are in 40-column mode, then BLOAD MSG.PRINT into your Apple, and type CALL 16384 from BASIC or type 4000G from the Monitor. MSG.PRINT clears the text screen and then prints two lines of text.

HOW MSG.PRINT WORKS

I have arbitrarily selected \$4000 as the starting address of MSG.PRINT (see line 15 of Listing 3). I could have selected \$0300 (the page 3 user's space) or \$9400 (near DOS or ProDOS) or any other free space.

In the EQUates section of MSG.PRINT (lines 21-25), MSGPTR is a special kind of variable called a pointer. Pointers are two-byte zero page locations that contain a two-byte address in reverse byte order, LOB (low-order byte) first and HOB (high-order byte) second. For example, if the two bytes at MSGPTR (\$00) and MSGPTR+1 (\$01) contained \$30 and \$40, respectively, we would say that MSGPTR points to the address \$4030.

I arbitrarily selected \$00 and \$01 as the address of MSGPTR. I could have selected any two-byte zero page sequence that does not interfere with DOS or BASIC usage. Safe addresses for your assembly language programs include \$00-\$09, \$1A-\$1C and \$1E-\$1F. If you are not sure how safe a zero page address is, consult your Apple // Reference Manual or What's Where In The Apple.

The other four symbols in the EQUates section are system addresses used by the Monitor ROM. CH is the zero page location that contains the horizontal position of the screen cursor. It uses values 0-39 (\$00 to \$27) in 40-column mode or 0-79 (\$00 to \$4F) in 80-column mode. TABV is the Monitor routine for setting the cursor at a specified location on the screen. HOME is the Monitor routine for clearing the text screen and moving the cursor to the upper-left corner. COUT, one of the most frequently used Monitor ROM routines, outputs a character to the screen. In addition, it handles screen scrolling and automatically updates the internal cursor values as each character is printed, so that the next character goes to the correct location.

Now let's go through the program itself to see how these Monitor ROM routines are used and to learn more about addressing modes. Line 31 clears the text screen. Lines 32-35 demonstrate a handy sequence of commands that set the cursor to any location on the text screen. To do this, load the

continued on page 103

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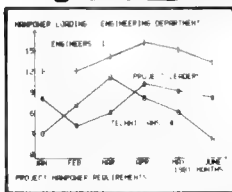
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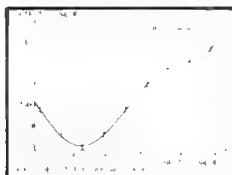
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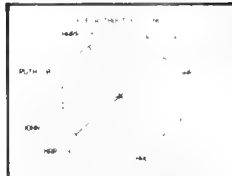
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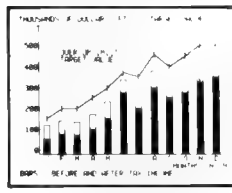
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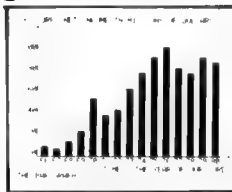
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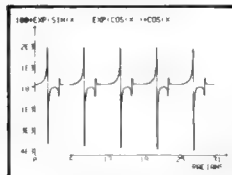
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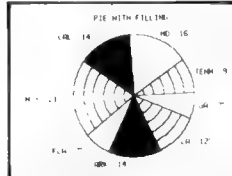
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CIRCLE NUMBER 34

LISTING 2: RAIN.ML (continued)

```

97 408E CE B2 40      DEC NDOTSON      :Decrease num dots
98 4091 AD B2 40      LDA NDOTSON      :Are they all gone?
99 4094 F0 14         BEQ QUIT          :Yes, so quit
100 4096 4C A1 40     JMP ENDLOOP       :Go to end of loop
101 4099 AE B5 40     LDX XVAL          :Get same X value
102 409C A0 00         LDY #0           :Make sure HOB is 0
103 409E 20 57 F4     JSR HPLOT         :Plot new point
104 40A1 AE B3 40     LDX LOOPINDX      :Restore loop index
105 40A4 CA           DEX              :Go to next index
106 40A5 10 AC        BPL MOVLOOP       :Not done
107 40A7 4C 50 40     JMP STARTMOV     :Jump to start
108
109                  * BASIC LINE 170.
110
111 40AA 20 39 FB      QUIT      JSR SETTEXT :Go set text mode
112 40AD 20 58 FC      JSR HOME  :Clear screen
113 40B0 60
114
115                  * *****
116                  * VARIABLES and DATA
117                  * *****
118
119 NUMDOTS DFS 1
120 NDOTSON DFS 1
121 LOOPINDX DFS 1
122 ARRINDX DFS 1
123 XVAL DFS 1
124 YVAL DFS 1
125 XRAIN DFS 18
126 YRAIN DFS 18
127 RAINFLAG DFS 18
128 40ED 16 00 1C      XSTART DFC 22,0,28,18,224,5,56,3,182,24,238,17
    12  E0 05 38 03 B6
129 40F9 D2 14 70      DFC 210,20,112,14,196,14,140,42,154,5
    0E C4 0E 8C 2A 9A
    05
130 4103 A8 02 46      DFC 168,2,70,10,126,16,98,4,17,10,84,21
    0A 7E 10 62 04 11
    0A 54 15
131 410F FC 00          DFC 252,0
4000 Errors
4000 Hex Start of Object
4110 Hex end of Object
0111 Hex Length of Object
7B33 Hex end of Symbols

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END OF LISTING 2

LISTING 3: MSG.PRINT

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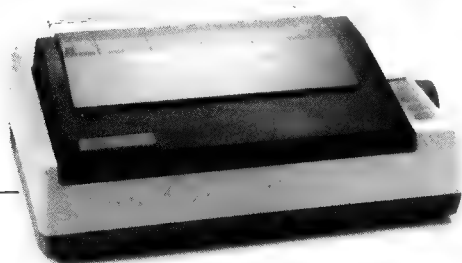
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desired horizontal position into CH (\$24); this has the same effect as the HTAB command in BASIC. Then, load the Accumulator with the desired vertical position (the VTAB value). Finally, call TABV, which does the necessary calculations for COUT to print the next character at the specified location.

Lines 37-40 set the message pointer, MSGPTR. The first message has the label MSG1 (line 66 of Listing 3). MSG1 is simply a group of bytes that contains the ASCII codes of the sentence "NIBBLING AT ASSEMBLY HAS IT ALL!" Lines 37-38 load the LOB (\$30) of MSG1 into the Accumulator and store the value into MSGPTR. Lines 39-40 load the HOB (\$40) of MSG1 into the Accumulator and store it into MSGPTR. MSGPTR now is pointing at the address of MSG1, namely, \$4030.

With MSGPTR pointing at the address of the message, line 41 calls the subroutine MSGPRINT (message print), which actually prints the message onto the screen. Lines 43-47 reset the pointer to the second message, MSG2, and again call MSGPRINT to print the second message.

The most important part of MSG.PRINT is, of course, the subroutine MSGPRINT, lines 54-60. This is how it works. Line 54 initializes the Y-Register to zero; this register serves as the index for the print loop. In line 55, the pointer MSGPTR loads a character into the Accumulator. This is a good example of the *indirect indexed* addressing mode. The LDA command here does not load the Accumulator with the value at MSGPTR; instead it loads the value pointed at by MSGPTR. In other words, the load is not direct (or absolute) but rather indirect.

Furthermore, LDA (MSGPTR),Y loads the Accumulator with the value pointed at by MSGPTR only when the Y-Register is zero. When the Y-Register is nonzero, the accessed memory address is indexed by the value in Y. For example, if the Y-Register contains 3 and MSGPTR is pointing at (or contains the address) \$4030, the byte value at \$4030+3 (that is, at \$4033) is loaded into the Accumulator.

Let's compare the indirect indexed addressing mode with other more familiar addressing modes. The assembly language statement LDA MSGPTR is an example of the absolute addressing mode, in which the Accumulator is loaded with the contents at the memory address MSGPTR (i.e., address \$00). The statement LDA MSGPTR,Y is an example of the absolute indexed addressing mode, in which the Accumulator is loaded with the contents at the address MSGPTR + Y. If Y contains \$01, the value at MSGPTR+\$01 is loaded into the Accumulator. In contrast, the statement LDA (MSGPTR),Y loads into the Accumulator the value contained at the address stored in MSGPTR and MSGPTR+1, offset by the value in the Y-

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Register. Indirect indexed addressing is further illustrated in the program AUTOTAB (Listing 4).

In MSG.PRINT (Listing 3), line 56 branches to the end of the MSGPRINT subroutine if the value loaded into the Accumulator is zero. Therefore, each message to be printed should be terminated with a zero (see line 67, in which the DFB assembler instruction generates a zero at the end of the first message).

Line 57 does the actual screen printing, through the subroutine COUT, as explained above. Line 58 increments the Y-Register to point at the next character in the message. This causes line 55 to load the Accumulator with the next character in the string pointed at by MSGPTR. Line 59 branches when Y is nonzero, which is always true (as long as the string being printed has fewer than 255 bytes). Finally, line 60 ends the subroutine and returns program control to the line following the subroutine call.

The actual string data is found in lines 66-70. As mentioned above, the first string, MSG1, contains the ASCII codes of the message, followed by a zero byte. The second string, MSG2, begins with two bytes of \$8D. This is the ASCII code for a carriage return; therefore, the second string is printed two lines below the first. The second string ends with another carriage return (line 70) and the necessary zero byte that indicates the end of the string. Notice the use of the pseudo-opcode ASC, which generates the ASCII code of the string. Most assemblers support this directive; consult your assembler's manual to see if your assembler supports ASC.

AUTOTAB

AUTOTAB is a utility that positions the cursor for PRINT statements in Applesoft programs. Instead of the cumbersome syntax:

HTAB 10: VTAB 7

for example, you can simply type:

&T10,7

when AUTOTAB is installed. Moreover, AUTOTAB can automatically center a line of print if you precede the PRINT command with &C40 (in 40-column mode) or &C80 (in 80-column mode).

Key AUTOTAB (Listing 4) into your assembler, assemble the program, and save both the source file and the object code (AUTOTAB) to disk.

USING AUTOTAB

To use AUTOTAB, include this line in your Applesoft BASIC program:

```
110 PRINT CHR$(4) ; "BRUN AUTOTAB"
```

Notice that you must BRUN, not just BLOAD, the program. Once AUTOTAB is installed, use the ampersand command syn-

LISTING 3: MSG.PRINT (continued)

```

44 4019 85 00          STA MSGPTR
45 401B A9 40          LDA #MSG2/      ;Do the HOB
46 401D 85 01          STA MSGPTR+1
47 401F 20 23 40       JSR MSGPRINT    ;Go print the message
48 4022 60             RTS             ;Return to BASIC
49
50                     ; ~~~~~
51                     ; MSGPRINT (Message print routine).
52                     ; ~~~~~
53
54 4023 A0 00          MSGPRINT LDY #0      ;Zero the index
55 4025 B1 00          MSGLOOP  LDA (MSGPTR).Y ;Get a character
56 4027 F0 06          BEQ ENDMSG        ;If zero, end
57 4029 20 ED FD       JSR COUT          ;Not zero, so print it
58 402C C8            INY               ;Bump the index
59 402D D0 F6          BNE MSGLOOP        ;Always loop
60 402F 60            ENDMSG  RTS         ;Return to caller
61
62                     ; ~~~~~
63                     ; DATA:
64                     ; ~~~~~
65
66 4030 CE C9 C2 MSG1   ASC 'NIBBLING AT ASSEMBLY HAS IT ALL'
        C2 CC C9 CE C7 A0
        C1 D4 A0 C1 D3 D3
        C5 CD C2 CC D9 A0
        C8 C1 D3 A0 C9 D4
        A0 C1 CC CC A1
67 4050 00             DFC 0
68 4051 8D 8D          MSG2   DFC $8D,$8D
69 4053 CD D3 C7       ASC 'MSGPRINT PRINTS MESSAGES '
        D0 D2 C9 CE D4 A0
        D0 D2 C9 CE D4 D3
        A0 CD C5 D3 D3 C1
        C7 C5 D3 AE
70 406C 8D 00          DFC $8D,0
000 Errors
4000 Hex Start of Object
406D Hex end of Object
006E Hex Length of Object
7BB0 Hex end of Symbols

```

END OF LISTING 3

LISTING 4: AUTOTAB

```

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```

```

                                AJTOTAB
                                by S Scott Zimmerman

                                Copyright (c) 1986
                                by MicroSPARC Inc
                                Concord, MA 01742

                                The MicroSPARC Assembler 3.0

                                ~~~~~

                                To activate AJTOTAB, BRUN it at the first of
                                your Applesoft program. The commands are

                                CURSOR TAB  &Tn m where n is HTAB and m is
                                           VTAB

                                CENTER PRINTING  &Cn where n 40 or 80 for
                                           40- or 80-column screen display

                                ~~~~~

                                ORG $0300      ;Page 3 user's space

                                ~~~~~
                                EQUATES
                                ~~~~~

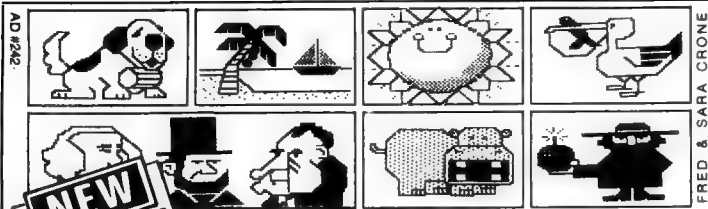
                                ROWNUM EQU 7      ;Current row number
                                NCHAR EQU 9       ;No characters in PRINT
                                CH EQU $24       ;Horiz cursor position
                                TXTPTR EQU $B8    ;Points to Applesoft text
                                AMPER EQU $3F5    ;Ampersand vector addr
                                GETBYTC EQU $E6F5 ;Skp char eval exprsn
                                COMBYTE EQU $E74C ;Check comma eval expr
                                TABV EQU $FB5B    ;Monitor TAB routine

                                ~~~~~
                                INITIALIZE
                                ~~~~~

                                0300 A9 4C          LDA #54C      ;JMP opcode
                                0302 8D F5 03       STA AMPER     ;Stuff in amper vector
                                0305 A9 10          LDA #START    ;Load starting address

```

continued on page 106



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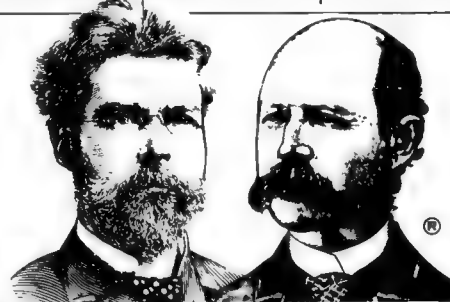
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tax described above for tabbing and centering text. For the centering command (&C) to work properly, the PRINT statement following the & command must contain the entire string within quotes (i.e., "STRING") and not in a string variable (such as AS), nor in an Applesoft expression. AUTOTAB only counts the number of characters within the quotes to calculate the centering location. Make sure that the string contains fewer than 40 characters in 40-column mode and fewer than 80 characters in 80-column mode.

AUTOTAB.DEMO (Listing 5) is a short Applesoft program that demonstrates the use of AUTOTAB.

HOW AUTOTAB WORKS

Lines 32-39 of AUTOTAB contain the EQUates to Applesoft and the Monitor ROM routines. ROWNUM and NCHAR are variables defined by the programmer, while the other EQUates are ROM locations or variables used by ROM. For example, TXTPTR is probably the most important pointer used by the Applesoft BASIC interpreter. TXTPTR (text pointer) points to the current Applesoft character in memory. AUTOTAB uses TXTPTR in the text centering routine.

AMPER (line 36) is the ampersand (&) vector address. (A vector is a sequence of bytes that redirects program control to another region of memory.) Lines 45-50 set up the & vector by first putting the JMP code (\$4C) at AMPER (address \$3F5). AUTOTAB then puts the LOB of the program starting address at AMPER + 1 (\$3F6), and puts the HOB of the program starting address at AMPER + 2 (\$3F7).

The main program starts in line 57 at address \$0310. This is the address to which the & vector points. When the Applesoft interpreter encounters an & in the program code, it does three things:

1. Increments the text pointer, TXTPTR, to point to the character immediately following the &
2. Loads the Accumulator with the byte value of the character after the &
3. Jumps to AMPER (\$3F5)

If a JMP code is located at \$3F5 (which is the case after BRUNing AUTOTAB), the program jumps to the address stored at AMPER + 1 and AMPER + 2, which, in this case, contains the address \$0310.

Lines 57-61 of AUTOTAB evaluate the byte in the Accumulator (the one immediately following the &) to see if there is a T or a C, and if so, it branches to the appropriate section of code.

Lines 67-73 contains the TAB routine. The Applesoft ROM routine GETBYTC is used to evaluate the expression following the T in the & call. The Applesoft expression may contain any combination of variables, constants, and arithmetic or logical opera-

LISTING 4: AUTOTAB (continued)

```

48 0307 8D F6 03      STA AMPER+1      .Save starting address
49 030A A9 03        LDA #START      .Now get HOB
50 030C 8D F7 03      STA AMPER+2      .And save it. too
51 030F 60           RTS
52
53                                     *-----*
54                                     * PROGRAM START *
55                                     *-----*
56
57 0310 C9 54      START    CMP #54      .Is it 'T'?
58 0312 F0 05      BEQ TAB      .Yes, go set tab
59 0314 C9 43      CMP #53      .Was it 'C'?
60 0316 F0 0F      BEQ CENTER    .Yes, go center print
61 0318 60         RTS          .None of above, so quit
62
63                                     *-----*
64                                     * TAB the cursor. *
65                                     *-----*
66
67 0319 20 F5 E6    TAB      JSR GETBYTC    .Eval expression of HTAB
68 031C CA          DEX          .Make range 0-39
69 031D 86 24      STX CH      .Store in mon HTAB loc
70 031F 20 4C E7    JSR COMBYTE    .Eval expression for VTAB
71 0322 CA          DEX          .Make range 0-23
72 0323 8A         TXA          .Put in accum for TABV
73 0324 4C 5B FB    JMP TABV      .Tab & return to BASIC
74
75                                     *-----*
76                                     * CENTER printing: *
77                                     *-----*
78
79 0327 20 F5 E6    CENTER    JSR GETBYTC    Evaluate expression for
80 032A 86 07      STX ROWNUM    # of chars/line & save
81 032C A9 00      LDA #0       .Zero the print chars
82 032E 85 09      STA NCHAR     .No characters in string
83 0330 A0 01      LDY #1       .Init the search index
84
85 0332 B1 B8      PRINTST    LDA (TXTPTR),Y .Get byte value from prgm
86 0334 C8         INY          .Increment to next char
87 0335 C9 22      CMP #52      .Is it a quote mark?
88 0337 D0 F9      BNE PRINTST .No, go get next char
89
90 0339 B1 B8      STRCOUNT    LDA (TXTPTR),Y .Yes, so count chars
91 033B C8         INY          .Go to next character
92 033C C9 22      CMP #52      .Is it a quote?
93 033E F0 09      BEQ CALTAB    .Yes, end of string
94 0340 C9 20      CMP #520     .Is it a control char?
95 0342 90 02      BCC CTRL     .Yes, so don't inc count
96 0344 E6 09      INC NCHAR     .Increase character count
97 0346 4C 39 03    CTRL      JMP STRCOUNT .Go check next character
98
99                                     Calculate the proper TAB for centering
100
101 0349 38          CALTAB      SEC          Calculate diff between
102 034A A5 07      LDA ROWNUM    no characters per row
103 034C E5 09      SBC NCHAR     .and no chars in string
104 034E 4A         LSR          .Divide the result by two
105 034F 85 24      STA CH       .Stuff into HTAB value
106 0351 60         RTS          Return to BASIC

```

000 Errors

0300 Hex Start of Object
0351 Hex end of Object
0052 Hex Length of Object
7B81 Hex end of Symbols

END OF LISTING 4

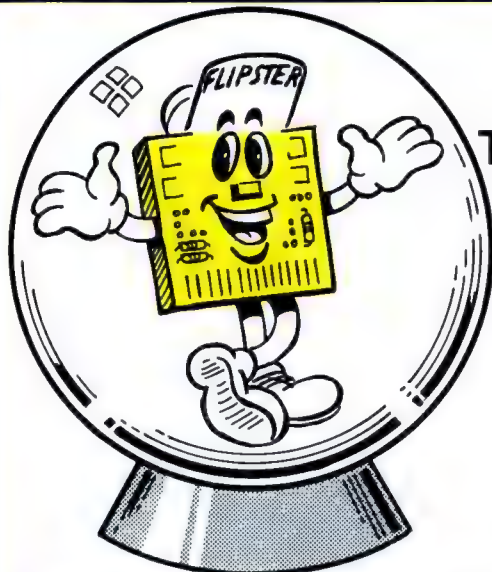
LISTING 5: AUTOTAB.DEMO

```

10 REM *****
20 REM * AUTOTAB DEMO *
30 REM * BY SCOTT ZIMMERMAN *
40 REM * COPYRIGHT (C) 1986 *
50 REM * By MICROSPARC, Inc *
60 REM * CONCORD, MA 01742 *
70 REM *****
80 REM
90 TEXT HOME : IF PEEK (1014) = 16 AND PEEK
(1015) = 3 THEN 110
100 PRINT CHR$ (4); "BRUN AUTOTAB"
110 & C40 INVERSE : PRINT "AUTOTAB " NORMAL
& T1,3 : & C40 PRINT "BY S SCOTT ZIMM
ERMAN" : & C40: PRINT "COPYRIGHT (C) 1986
BY MICROSPARC"
120 & T3,10 PRINT " >AUTOTAB AUTOMATICALLY
TABS. "
130 & T1,13. & C40: PRINT "->IT AUTOMATICALL
Y CENTERS < "
140 & T3,19. PRINT "JUST REMEMBER TO BRUN AU
TOTAB AND" PRINT "THEN USE &-COMMANDS A
S SHOWN IN THIS" PRINT "DEMONSTRATION P
ROGRAM "

```

END OF LISTING 5



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tions. If the program contains the command &T10,5, GETBYTC would cause TXTPTR to skip the T, evaluate the expression, and put the result (10 or \$0A) into the X-Register. Since Applesoft tabs use the range 1-40, but CH and TABV (see above) use the range 0-39, AUTOTAB decrements the X-Register in line 68 before storing the results in CH.

After GETBYTC evaluates an expression, TXTPTR is left pointing to the character following the expression. COMBYTE is a related Applesoft ROM routine that checks for a comma before evaluating an expression. This is just what we want for evaluating the expression after the comma in &T10,5. Hence, line 70 calls COMBYTE which, in this example, puts a five in the X-Register. AUTOTAB decrements the X-Register (line 71) to adjust the tab range, transfers the result from the X-Register to the Accumulator (TABV requires the vertical tab in the Accumulator), and calls the TABV routine. Notice that AUTOTAB could have used a JSR TABV followed by an RTS to end the routine, but instead it simply JMPs to TABV and thereby saves one byte.

The CENTER routine is a little more complicated. It uses GETBYTC (line 79) to check for 40-column or 80-column centering, and stores the result in the variable ROWNUM (line 32). Lines 81-82 zero the

NCHAR, used to count the number of characters in the PRINT string.

At this point in the program, the Applesoft text pointer, TXTPTR, is pointing at the character in the BASIC line of code following the &C40 or &C80 command. AUTOTAB now uses TXTPTR to count the

.....
*...the object code is only
273 bytes, compared to 347
bytes for the BASIC
program.*
.....

number of characters in the next PRINT string. This starts on line 85, which is the beginning of a loop to search for the first quote mark (") in the print string. The command:

LDA (TXTPTR),Y

which is the indirect indexed addressing mode, loads the byte value of a character in the BASIC line, INY increments the index

to point to the next character, and CMP #52 checks whether the number in the Accumulator is the ASCII code for a quote mark.

When AUTOTAB finds the first quote mark, the program drops down to line 90, where it begins a search for the second quote mark, counting the number of characters in between.

Once AUTOTAB finds the second quote mark, the program goes to line 101, where it calculates the HTAB necessary to center the string. I will not try to explain the calculations at this time.

In the next installment of Nibbling At Assembly Language we'll discuss assembly language arithmetic. In the meantime, analyzing AUTOTAB will challenge your assembly language programming skills.

Dr. Zimmerman has just co-authored (with Beverly Zimmerman) a book entitled Action Games for the Apple: How to Design Computer Games, (Scott, Foresman and Co., 1900 East Lake Ave., Glenview, IL 60025). The book is designed for Applesoft programmers, and contains software tools, tips and techniques for programming sound effects, music, graphics and animation. The book includes three utilities (with assembly language subroutines) and 11 example games.



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ProDOS DIRECTORY LIST

by Keith Stattenfield

TIPS 'N TECHNIQUES

Use this ProDOS

utility to list all the files on a disk, including all subdirectories, to a 40- or 80-column screen or a printer.

ProDOS is a big step forward in both convenience and organization. Unfortunately, to anyone familiar with DOS 3.3, some things seem very difficult, while others are downright impossible. One difficulty is finding out exactly what is on a disk. ProDOS allows for multiple catalogs. When you type CATALOG, a directory appears that may contain several subdirectory files. Typing CATALOG followed by a space and the name of one of these subdirectories displays a new catalog. This system creates a capacity for file organization: one subdirectory may contain utility programs, while another contains data files, and yet another contains text files. ProDOS allows for the interface of hard disks, and on a hard disk, this type of file organization is far superior to that provided by DOS 3.3. However, on floppy disks, this system can be somewhat confusing.

It creates a problem. To see all the files on a disk, you have to catalog each subdirectory separately, a task that is time-consuming and error prone. ProDOS Directory List rescues you from this task. This utility program lists all the files in each of the directories on any ProDOS disk.

USING THE PROGRAM

To use the program, simply RUN it and enter the path name of the base directory (or the slot and drive of the disk that contains the base directory). The base directory is the directory in which the program starts looking. If it finds any subdirectories it will list them, and then any subdirectories in these subdirectories are listed, and so on.

If you specify the volume directory for a disk, all of the files

on the disk will be listed. If you specify the slot and drive of the disk, the program will find the name of the volume directory of the disk in that drive and use that name as the base name.

After the path name has been entered and checked, the program asks whether or not to send the output to the printer. Currently, the program assumes that the printer is in slot 1, and the format string to be sent to the printer is in line 130. (If your setup is different, see HOW IT WORKS below.) If you want to send the listing to the printer, press Y; if not, press N. If you press N, then the program will ask whether to send output to an 80-column card. If you don't have an 80-column card or if you only want to see 40 columns of the catalog, press N. If you press Y, the program expects the 80-column card in slot 3.

Next, the listing is displayed. Press <CTRL>S to pause if you are listing to the screen. After the listing finishes, you have the option to display it again.

ENTERING THE PROGRAM

To key in the program, type in the Applesoft program shown in Listing 1 and save it with the command:

SAVE DIRECTORY.LIST

For help in entering *Nibble* listings, see "A Welcome to New *Nibble* Readers" at the beginning of this issue.

HOW IT WORKS

Unlike DOS 3.3, ProDOS allows an OPEN operation on any type of file. This means that if you open a directory file, ProDOS will return the catalog line by line. ProDOS Directory List takes the following steps to list the catalog:

1. Opens the base directory as a file of type DIR.
2. Reads the three descriptor lines at the beginning of each catalog.

Keith Stattenfield, 908 Perry Ave., Racine, WI 53406. ProDOS Directory List is compatible with ProDOS only.

3. Reads a line of the catalog.
4. Checks the MID\$ of each catalog entry from the 18th character to the 20th character. This is the file type. If this string is DIR, then the complete path name of the current file is saved in the end position of a string array.
5. Goes back to step 3 until the last line of the current catalog has been read.
6. Checks whether the end of the array, which contains the names of the next subdirectory, has been reached. If not, the file named

This utility program lists all the files in each of the directories on any ProDOS disk.

in the next element in the array is opened as a file of type DIR and program flow returns to step 2.

The program assumes that the printer is in slot 1. If your printer is in a different slot, change the number assigned to the variable PR% in line 170 (Listing 1) accordingly. Also, change the format string in line 130 to conform to your printer.

One interesting part of the program is the "input anything" routine used to get the path name. Its use is simple. The statement:

CALL 768,A\$:A\$=A\$+" "

returns the string in A\$.

APPLICATIONS

ProDOS Directory List could be inserted into another program to streamline the process of finding a file in a subdirectory of several disks. It could also be converted to machine language and a new command added to ProDOS (perhaps something like FIND *file-name*), which would scan all of the current devices and return the path name of the file in question.

This same technique could be used to list only certain file types in a catalog, or only locked files, for instance. Since the file type and file status can be easily determined from the CATALOG string, listing just the files with specific characteristics would be very easy.

Nibble Light Pen, ProDOS Directory List, ProCursor, DISPLAY and programs from Nibbling at Assembly Language V are available on diskette for an introductory price of \$17.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: DIRECTORY.LIST

```

10 REM *****
20 REM *   DIRECTORY.LIST   *
30 REM * BY KEITH STATENFIELD *
40 REM * COPYRIGHT (C) 1986 *
50 REM * BY MICROSPARC, INC *
60 REM * CONCORD, MA 01742 *
70 REM *****

```



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```

80 REM
90 REM FS$ CONTAINS THE PRINTER SETUP STRIN
  G.
100 REM IT IS CURRENTLY SET UP FOR THE GRAP
  PLER INTERFACE
110 REM AND APPLE DMP PRINTER.
120 REM
130 FS$ = CHR$ (9) + "80N" + CHR$ (9) + "60
  P" + CHR$ (27) + "E" + CHR$ (27) + "L0
  10"
140 REM
150 REM PR% IS THE PRINTER SLOT
160 REM
170 PR% = 1
180 GOTO 280
190 REM
200 HTAB 20 - LEN (A$) / 2 + 1: PRINT A$: RETURN

210 INVERSE : GOSUB 200: NORMAL : RETURN
220 GOSUB 200:A$ = LEFT$ ("-----
  -----", LEN (A$)): GOSUB
  200: RETURN : REM 40 -'S
230 VTAB 9: HTAB 1: CALL - 958: PRINT : RETURN

240 A$ = "PRESS <RETURN> TO CONTINUE": VTAB 2
  3: GOSUB 200: POKE - 16368,0: WAIT - 1
  6384,128
250 VTAB 23: CALL - 868: POKE - 16368,0: RETURN

260 GET A$:YES = (A$ = "Y") + (A$ = "y"): ON
  NOT (YES + (A$ = "N") + (A$ = "n")) GOTO
  260: PRINT A$: RETURN
270 REM
280 REM -- START OF MAIN --
290 REM -- PROGRAM --
300 TEXT : HOME : DIM DIR$(100)
310 PRINT CHR$ (17);
320 VTAB 2:A$ = "DIRECTORY.LIST": GOSUB 200
330 PRINT :A$ = " BY KEITH STATTFIELD": GOSUB

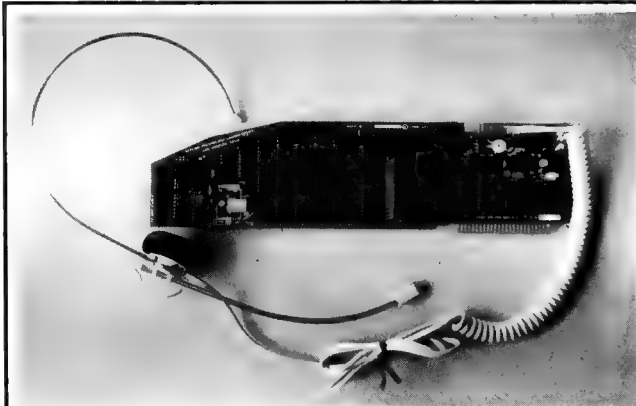
```

```

200: PRINT :A$ = " * COPYRIGHT (C) 1986 B
  Y MICROSPARC,INC *": GOSUB 200
340 VTAB 8: PRINT "-----
  -----": REM 40 -'S
350 PTR = 768:DL$ = "-----
  -----": REM !80 DASHES !
360 READ A: IF A > - 1 THEN POKE PTR,A:PTR
  = PTR + 1: GOTO 360
370 POKE 34,8: HOME
380 D$ = CHR$ (4)
390 PRINT D$"PREFIX": INPUT OP$
400 GOSUB 230: PRINT "ENTER THE NAME OF THE
  VOLUME OR": PRINT "DIRECTORY FOR THE BAS
  E TO LIST"
410 PRINT : PRINT "DEFAULT IS ":OP$
420 PRINT : PRINT "SLOT AND DRIVE CAN BE SPE
  CIFIED (,S#,D#)"
430 VTAB 18: PRINT "":OP$
440 VTAB 18: HTAB 2: CALL 768,NP$:NP$ = NP$ +
  ""
450 IF NP$ = "" THEN NP$ = OP$
460 VTAB 18: HTAB 2: PRINT NP$
470 ONERR GOTO 490
480 PRINT : PRINT D$"PREFIX"NP$: PRINT D$"PR
  EFIX": INPUT NP$: GOTO 500
490 GOSUB 230:A$ = "ERROR #" + STR$ ( PEEK
  (222)) + " IN PREFIX": GOSUB 210: GOSUB
  240: RUN
500 POKE 216,0: VTAB 18: HTAB 2: PRINT NP$:
  CALL - 958: PRINT
510 VTAB 23: PRINT "LIST CATALOG ON PRINTER?
  ": GOSUB 260
520 PR = 0: IF YES THEN PR = PR%
530 VTAB 23: HTAB 1: CALL - 868: IF NOT PR
  THEN PRINT "LIST ON 80-COLUMN SCREEN?"
  :: GOSUB 260: IF YES THEN PR = 3
540 IF PR = PR% THEN PRINT FS$
550 LN = 39 + (40 * (PR > 0))

```

continued on next page



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LISTING 1: DIRECTORY.LIST (continued)

```

560 P1 = 1:P2 = 1:DIR$(1) = NP$
570 REM
580 REM - PERFORM THE CATALOG -
590 REM
600 TEXT : HOME
610 PRINT : PRINT DS"PR#":PR: IF PR = PR% THEN
    PRINT FS$
620 PRINT DS"OPEN "DIR$(P1)".TDIR"
630 PRINT DS"READ "DIR$(P1)
640 INPUT TS: PRINT "CATALOG OF ".DIR$(P1)
650 INPUT TS: PRINT LEFT$(TS,LN)
660 INPUT TS: PRINT LEFT$(DL$,LN)
670 ONERR GOTO 770
680 INPUT NAMES:NAMES$ = NAMES$ + " "
690 IF NAMES$ = "" THEN 770
700 TY$ = MID$(NAMES$,18,3)
710 PRINT LEFT$(NAMES$,LN)
720 IF TY$ < > "DIR" THEN 680
730 NAMES$ = MID$(NAMES$,2,16): IF RIGHT$(D
    IRS$(P1),1) < > "/" THEN NAMES$ = "/" + N
    AMES$
740 IF RIGHT$(NAMES$,1) = " " THEN NAMES$ =
    LEFT$(NAMES$, LEN(NAMES$) - 1): GOTO 74
    0
750 P2 = P2 + 1:DIR$(P2) = DIR$(P1) + NAMES$
760 GOTO 680
770 REM
780 REM - WE'RE DONE WITH THAT CATALOG.
790 REM SO CLOSE THE DIRECTORY & DO
800 REM THE NEXT ONE -
810 REM
820 PRINT : PRINT DS"CLOSE"
830 IF P1 = < P2 THEN P1 = P1 + 1: GOTO 620
840 IF PR AND PR < > 3 THEN PRINT DS"PR#0"
850 VTAB 24: HTAB 1: CALL - 868: GOSUB 240
860 VTAB 23: HTAB 1: CALL - 868
870 PRINT "PERFORM ANOTHER CATALOG?": GOSUB
    260
880 IF YES THEN RUN
890 TEXT : HOME END
900 REM
910 REM - INPUT ANYTHING MACHINE CODE DATA
    -
920 REM
930 DATA 32,190,222,32,227,223,162,0,32,117,
    253,160,0,138,145,131,200,169,0,145,131,
    200,169,2,145,131,32,57,213,96
940 DATA -1

```

END OF LISTING 1

KEY PERFECT 5 0 RUN ON DIRECTORY LIST

CODE-5 Ø	LINE# - LINE#	CODE-4 Ø
7C62FD67	10 - 100	7500
DAF88DD9	110 - 200	4291
A690B7C4	210 - 300	A076
1A3753F4	310 - 400	C996
6171C152	410 - 500	795A
4F012FD2	510 - 600	679C
39F36578	610 - 700	6740
BCFC0CCE	710 - 800	7266
F09FFC02	810 - 900	48A9
0D5D3B28	910 - 940	4B3B
8AE7AAF0	= PROGRAM TOTAL =	09B6



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ProDOS OUTPUT PROCESSING

by Sandy Mossberg

DISASSEMBLY LINES

The ProDOS BASIC interpreter's output handling routines, along with the relevant Applesoft output routines, are analyzed. In addition, a fix for a BI bug is provided.

The last installment of Disassembly Lines (Vol. 6/No. 11) examined input processing by the ProDOS BASIC interpreter (BI). This time we take on the complex and somewhat top-heavy code associated with character output. The bloated output code stems from the incorporation of trace mode into the BI (DOS 3.3 ignores tracing).

More exciting even than the disassembly was the detective work required to isolate a BI bug that flips trace mode on and off at inopportune moments. If you are a fan of A. Conan Doyle or Agatha Christie, you will find this section downright exhilarating.

OUTPUT STATES

You may want to review the descriptions of I/O hooks, vectors and states in the last D/L column. State numbers designate an index into the I/O state table (\$B7F7 for BI 1.1; \$B851 for BI 1.0). Whereas input is processed by two state handlers, immediate (KSTATE0) and deferred (KSTATE48), output requires four separate routines: STATE 0 (immediate mode), STATE 4 (deferred mode), STATE 8 (assembling command line in deferred mode), and STATE D (checking for <CTRL>D).

APPLESOFT ROM

Before tackling BI output processing (Listing 1), we must understand the interaction between Applesoft ROM and the BI. Listing 2 includes several Applesoft routines, two of which were published in earlier D/L columns (NEWSTT from Vol. 4/No. 2, and OUTDO from Vol. 4/No. 4). Both of the original columns are contained in *Disassembly Lines, Volume 1*, a compendium of articles about Applesoft ROM. Only pertinent sections of the code will be covered here.

First, let us briefly review how Applesoft stores programs. Keywords (i.e., statements or commands) are converted by PARSE (\$D559) into tokens, each of which is stored in program memory as a negative ASCII (high bit set) byte. Numerals and variables are kept in positive ASCII (high bit clear) format. When the Applesoft interpreter searches a program and finds a negative ASCII character, a token is inferred and program flow is transferred to the handler for that particular token. We shall observe how this works later on.

All Applesoft statements, immediate and deferred, are processed by NEWSTT (lines 46-109 of Listing 2). After some housekeeping chores, execution begins at line 75, where the Applesoft trace flag is tested. If clear (line 76), flow drops to GETSTT (line 86), where the next program byte is obtained and processed (lines 87 and 92-103). If the

trace flag is set, lines 77-78 ensure that immediate mode is not active, and line 81 prints the trace character (#) by calling OUTDO (lines 115-125), the standard Applesoft output subroutine. To make certain that the BI would control all tracing activity, the Apple's software writers resolved that the Applesoft trace flag must always be set so that the BI could gain control when OUTDO calls COUT. (Remember, COUT jumps to the address at \$36-\$37, which is the current BI intercept.)

Thus, the master plan is to trap all Applesoft new statement processing at OUTTRACE (line 81) and control true tracing within the BI. As we dissect the BI output code in Listing 1, we shall learn how this process works.

IMMEDIATE MODE

The STATE 0 output handler begins by checking if the character to be output is the trace character whose image is stored at \$9F61 (\$9F98 in BI 1.0) in line 521 of Listing 1. Except for one circumstance, noted later, TRACECHR is the expected pound sign (#). If the trace character is not being printed, flow drops to lines 109-116, where the character is echoed if it does not represent a consecutive carriage return (CR). Lines 120-126 suppress a consecutive CR only if it occurs at the start of a line and a BI command is not pending. (The necessity for this manipulation is beyond my ken. If

by Sandy Mossberg, 50 Talcott Rd., Rye Brook, NY 10573

someone can enlighten me, I shall be in your debt.) The "command pending" decision is made by testing the first character in the BI text buffer, TXBUF (also called path name buffer and command buffer), for ASCII \$3F (the question mark) or greater. Since commands and path names begin with alphabetic characters, it would seem more appropriate to test for ASCII \$41 (A) or greater.

If the trace character is being output, X is saved (line 90) and lines 91-96 determine whether the output request comes from OUTRACE (that important line 81 in NEWSTT). This technique requires explanation. When JSR OUTDO is executed at \$D810 (OUTRACE) and JSR COUT is subsequently executed at \$DB5F (PRCHR), the stack contains both return addresses (minus one) (see Table 1). If the lower address is \$D812, OUTRACE output is confirmed, in which case, control drops to lines 101-105, where deferred mode is set and the trace character is printed via the STATE 4 output handler. I suspect that these latter lines were designed to trap inadvertent entry into immediate mode from deferred mode, but I do not understand how OUTRACE can be called from immediate mode because EXECUTE (lines 75-88 of Listing 2) skips OUTRACE if immediate mode is operational. Again, I solicit your help in understanding how lines 101-105 can ever be executed.

If the trace character is being printed, but Applesoft is not tracing (i.e., output does not come from OUTRACE), line 97 branches to lines 130-131, where X and the trace character are restored and flow drops to the character output routine.

CHARACTER OUTPUT

After placing the true I/O handler addresses at the I/O hooks (line 137), the target character is printed. If it is not a CR (lines 142-143), exit occurs by restoring the true I/O handlers to the global page and resetting the BI intercepts.

The BI assiduously maintains the Applesoft trace flag at a value of \$A5. When the TRACE or NOTRACE command is given in immediate mode, Applesoft kicks flow to the appropriate statement handler (lines 156-163 of Listing 2) where either a set carry (TRACE) or clear carry (NOTRACE) is rotated into bit 7 of TRCFLG. (The old skip-a-byte trick is used in line 157 to create the expression BCC \$F288 for the purpose of bypassing the CLC instruction when entry is at TRACE.) When the BI next gains control to output a CR, lines 147-148 of Listing 1 test for a change in the Applesoft trace flag. If not found, the BI knows that either NOTRACE or TRACE has been executed in immediate mode. In such a circumstance, TRCFLG would contain either \$52 (NOTRACE rotates \$A5 right and clears bit 7) or \$D2 (TRACE rotates \$A5 right and sets bit 7). Therefore, if the trace flag has been changed, line 150 stuffs the rotated value

(e.g., \$52 or \$D2) into the true BI trace flag (DTRACE), and lines 151-152 reset TRCFLG to \$A5. The CR is restored to the Accumulator (line 153) and exit occurs.

DEFERRED MODE

STATE 4

VSTATE4 is the main code for processing output in a running program. The initial segment (lines 279-287) is identical to YSTATE0. If output is coming from OUTRACE, control branches to BI trace processing, which is detailed in the next section. If nontrace output is encountered, the entry A and X Registers are restored (lines 292-293) and file output activity is tested. If a character is being written to a file and that character is neither the immediate mode prompt nor a CR, it is output forthwith (lines 301-309). If the right bracket prompt is being printed (line 304), flow resumes at lines 349-350, where registers are saved and files are tested. If no file is open (line 352), registers are restored (line 363) and the immediate mode prompt is echoed

TRACE PROCESSING

When OUTRACE output is confirmed in VSTATE4 (line 288), control passes to BITRACE (lines 381-517), which processes Applesoft tokens and controls tracing of Applesoft and ProDOS BASIC statements. Entry is always at line 383 where the low-order byte of the text pointer is incremented. If a page boundary is encountered (line 384), lines 381-382 increment the high-order byte. Lines 388-389 set PROMPT equal to \$FF. If this value is unchanged when the STATE 4 handler regains control, consecutive nontokens are flagged, and lines 313-314 use this condition to detect successive CRs.

After restoring the stack pointer (the S-Register) to its value on entry to NEWSTT (lines 46-47 of Listing 2), which effectively pops two addresses from the stack, DTRACE, the true BI trace flag, is tested (line 398). If it is active (line 399), control passes to lines 494-504, where the trace character and line number are printed, and program flow is routed back to line 403.

If DTRACE is inactive, program flow falls to lines 403-404, where the next pro-

TABLE 1: Stack Contents When Applesoft is Tracing

Sequence	Location	Instruction	S-Register	Stack Contents	Stack Address
4	\$9E2C	(BI entry)	\$F4	-	\$1F4
3	\$DB3A	JSR \$FDED	\$F5	\$3C	\$1F5
			\$F6	\$DB	\$1F6
			\$F7	\$12	\$1F7
2	\$D810	JSR \$DB57	\$F8	\$D8	\$1F8
1	\$D7D2	(NEWSTT entry)	\$F8	-	\$1F8

(line 364). On finding one or more files open, lines 355-364 flush buffered data, clear the file output flag, set true I/O handlers, print FILE(S) STILL OPEN, restore registers and echo the right bracket.

If file output is active and a CR is found, lines 313-314 check PROMPT (\$33) for consecutive CRs (see the explanation below). Whereas a single CR is written directly to the file buffer (line 316), two CR's in sequence flush the file buffer (line 317), clear the file output flag (line 318), and print the CR to the screen or printer rather than to the file buffer (line 320).

If file output is not active (line 295), control passes to lines 325-327, where the active file and/or prefix input are tested. If it's found and if the input token is being processed in lines 332-335 (token handling is described below), the echo of the question mark prompt is suppressed by lines 368-375. Again, this double-CR handling mystifies me.

If neither file output nor file/prefix input is active (line 328), lines 339-343 echo all but the immediate mode Applesoft prompt character.

gram character is obtained. If a token is found (line 405), processing resumes at line 436. If the end-of-line marker (zero) is picked up (line 406), a branch to lines 429-430 conditions the processor status byte (P-Register) and flow jumps to one instruction beyond GETSTT (line 87 in Listing 2). If a nontoken is located, lines 410-420 are responsible for the automatic garbage collection that is such a convenient feature of ProDOS BASIC.

STRINGS (\$BE49) is an arbitrary counter that is decremented each time a nontoken is picked up. Every so often (i.e., when STRINGS equals zero), free space is tested. If three pages or more are free, garbage collection is deemed unnecessary. Less than three pages of unused space triggers flushing of the temporary (general purpose) data buffer, full-scale garbage collection and reset of STRINGS. In either circumstance, flow resumes at lines 424-425, where the same nontoken is obtained and control is routed to Applesoft ROM (lines 429-430).

Token processing (line 436) is the start of the real fun. Since the BI has intercepted Applesoft statement processing, it must pro-

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vide reentry to NEWSTT (as noted above in lines 429-430). Before it does so, however, the BI imposes its will on several tokens. A table of Applesoft statement tokens is kept by the BI (APTKNTBL, lines 569-590). Tokens that are handled normally are stored in the usual negative ASCII format. Tokens that require special processing are replaced by branch offsets (positive numbers), the nature of which we shall see shortly.

Here's how it works. Lines 436-437 store the token in PROMPT and convert the token to an index into APTKNTBL. Line 438 fetches the table entry. If it is negative (i.e., in the normal format) in line 439, Applesoft is reentered. A positive table entry is used to modify (line 440) the branch instruction in line 441. For example, if the LIST token (\$BC) is encountered, table entry \$13 (line 589) is placed at location \$9EFD (line 441). The branch now goes to line 456, where the LIST token is processed. Some programmers eschew the use of self-modifying code. I like it.

Individual tokens are handled as described below:

PRINT and IF Tokens — <CTRL>D following a PRINT statement is the signal for the BI to anticipate a command. When a PRINT token is found, a zero is stuffed into PROMPT (line 446), memory of the prior character is wiped out (line 447), STATE D is set (lines 448-451), and line 452 branches to line 482 where the token is restored to the Accumulator and Applesoft is reentered. The next output will check for <CTRL>D via the STATE D handler. I don't know why the IF statement requires similar processing.

LIST and CALL Tokens — When LIST and CALL are encountered, PROMPT is flagged with the values 1 and 2, respectively, and Applesoft is accessed (lines 456-464).

LET Token — Lines 468-469 restore the token to the Accumulator and jump to the code that checks for garbage collection.

TRACE and NOTRACE Tokens — The BI trace flag is set by storing the TRACE token (\$9B) in DTRACE (line 473) and branching (line 474) to lines 480-481, where the value \$4A is stuffed into the Applesoft trace flag. On the surface, this would seem to clear TRCFLG (a no-no!), but actually, once the Applesoft trace handler rotates a set carry into bit 7 of TRCFLG, the familiar \$A5 will be present. After restoring the token to the Accumulator, Applesoft is entered (lines 482-483).

Following the NOTRACE command, DTRACE is cleared by receiving the branch offset (\$28) (line 478). Line 479 converts NOTRACE to TRACE so that TRCFLG is

continued on page 122

LISTING 1: BI Output Processing

Note: Don't enter this code. It already exists in the BI.

```

1 *****
2 =
3 = OUTPUT PROCESSING
4 = ProDOS BASIC INTERPRETER version 1.1
5 = [BI 1.0 addresses bracketed]
6 *
7 * Interpreted by
8 * Sandy Mossberg
9 *
10 *****
11
12 * Merlin-Pro Assembler
13
14 * General Equates:
15
16 CH = $24 ;Column position of cursor
17 PROMPT = $33 ;Prompt character
18 CSWL = $36 ;Output hook
19 KSWL = $38 ;Input hook
20 STREND = $6D ;Bottom of arrays
21 FRETOP = $6F ;Bottom of strings
22 MEMSIZ = $73 ;HIMEM
23 CURLIN = $75 ;Current line number
24 TXTPTR = $B8 ;Apsoft text pointer
25 ERRNUM = $DE ;Error code number (Applesoft)
26 TRCFLG = $F2 ;Apsoft trace flag
27 REMSTK = $F8 ;Stack pointer (Applesoft)
28 STACK = $100 ;Stack
29 INBUF = $200 ;Input buffer
30 COUT = $FDED ;Output char via CSW hook
31
32 * BI Proper Equates:
33
34 SETIOTRU = $9A00 ;Set true I/O handlers [same]
35 ERROR = $9AEE ;Error handler [$9B22]
36 REGSAV = $9F62 ;Save entry registers [$9F99]
37 REGRST = $9F6C ;Restore entry registers [$9FA3]
38 SETSTATE = $9F76 ;Set STATE handlers [$9FAD]
39 FRECMD = $A044 ;FRE command [$A07B]
40 SYNTAX = $A677 ;Parse command line [$A6B4]
41 DOSOUT = $B7F1 ;BI output intercept [$B84B]
42 STATE = $B803 ;STATE D output handler [$B85D]
43 TXBUF = $BCBD ;Text buffer [same]
44
45 * Applesoft ROM Equates:
46
47 OUTTRACE = $D810 ;Output trace char
48 GETSTT = $D81D ;Execute Apsoft statement
49 LINPRT = $ED24 ;Print decimal of A,X
50
51 * BI Global Page Equates [same]:
52
53 PRINTERR = $BE0C ;Print error message
54 VECTOUT = $BE30 ;True output handler
55 VECTIN = $BE32 ;True input handler
56 VDOSIO = $BE34 ;BI intercepts
57 VYSIO = $BE38 ;Current state handlers
58 PREGX = $BE3F ;Save X-reg
59 PREGY = $BE40 ;Save Y-reg
60 DTRACE = $BE41 ;BI trace flag
61 IFILACTV = $BE44 ;Input file active (if M1)
62 OFILACTV = $BE45 ;Output file active (if M1)
63 PFXACTV = $BE46 ;Prefix input active (if M1)
64 STRINGS = $BE49 ;Counter for free string space
65 TBUFPTTR = $BE4A ;Temp buffer char count (WRITE)
66 INPTR = $BE4B ;Index to command line
67 CHRLAST = $BE4C ;Last char output
68 OPENCNT = $BE4D ;Number of open nonEXEC files
69 GOSYSTEM = $BE70 ;Call MLI
70 RWCOUNT = $BED9 ;R/W request.count parameter
71
72 * Special Equates.
73
74 input = $84 ;INPUT token
75 ctld = $84 ;CTL-D (negative ASCII)
76 cr = $8D ;CR (negative ASCII)
77 space = $A0 ;Space
78 WRITE = $CB ;MLI WRITE call
79
80 -----
81 * STATE 0 Output Handler (Immediate Mode) [same].
82 -----
83
84 ORG $9A2F
85
86 * Check if Applesoft is tracing:
87
88 VIDINCPT
89 VSTATE0 CMP TRACECHR
90 BNE :1 ;Trace char not being output
91 STX PREGX ;Save entry X
92 TSX ;Use stack pointer as offset
93 LDA STACK+3,X ;Check stack for Apsoft
94 CMP #OUTTRACE+2 ; trace printing
95 BNE :3 ;Not trace printing

```

```

9A3F: 8D 04 01 95      LDA  STACK+4,X
9A42: C9 08 96      CMP  #>OUTRACE+2
9A44: D0 28 97      BNE  :3      ;Not trace printing
98
99
* Applesoft is tracing:
100
9A46: A2 04 101      LDX  #4
9A48: 20 76 9F 102      JSR  SETSTATE      ;Set deferred mode
9A4B: AD 61 9F 103      LDA  TRACECHR      ;Restore entry A
9A4E: AE 3F BE 104      LDX  PREGX      ;Restore entry X
9A51: 4C F1 B7 105      JMP  DOSOUT      ;Output the trace char
106
* Applesoft not tracing:
107
9A54: CD 4C BE 109      CMP  CHRLAST      ;Same as last char output?
9A57: 8D 4C BE 110      STA  CHRLAST      ;Remember current char
9A5A: D0 18 111      BNE  CHAROUT      ;Output different char
112
* -> Check for consecutive CRs:
113
9A5C: C9 8D 115      CMP  #cr      ;Two consecutive CRs?
9A5E: D0 14 116      BNE  CHAROUT      ;No, so output char
117
* -> Consecutive CRs found:
118
9A60: A5 24 120      LDA  CH      ;If not start of line,
9A62: D0 05 121      BNE  :2      ; output 2nd CR
9A64: AD BD BC 122      LDA  TXBUF      ;At start of line. Suppress
9A67: C9 3F 123      CMP  #'?'      ; 2nd CR if command
9A69: A9 8D 124      LDA  #cr      ; not pending
9A6B: B0 07 125      BCS  CHAROUT      ;Output 2nd CR
9A6D: 60 126      RTS      ;Ignore CR
127
* Trace character being output: Applesoft not tracing.
128
9A6E: AE 3F BE 130      LDX  PREGX      ;Restore entry X
9A71: AD 61 9F 131      LDA  TRACECHR      ;Prepare to output trace char
132
* Echo Output Character [same]:
133
* Output the character:
134
9A74: 20 00 9A 136      CHAROUT JSR  SETIOTRU      ;Set true I/O handlers
9A77: 20 ED FD 137      JSR  COUT      ;Output char
138
* Check for CR:
139
9A7A: C9 8D 142      CMP  #cr
9A7C: D0 0F 143      BNE  SAVIOTRU      ;CR not output
144
* CR found
145
9A7E: A5 F2 147      LDA  TRCFLG
9A80: C9 A5 148      CMP  #SA5
9A82: F0 07 149      BEQ  1      ;Normal value in trace flag
9A84: 8D 41 BE 150      STA  DTRACE      ;Set/clear for immediate mode
9A87: A9 A5 151      LDA  #SA5      ;Restore normal value
9A89: 85 F2 152      STA  TRCFLG      ; in trace flag
9A8B: A9 8D 153      LDA  #cr      ;Restore A
154
* Save True I/O Handlers in BI global page [same]
155
9A8D: 48 157      SAVIOTRU PHA
9A8E: A5 39 158      LDA  KSWL+1      ;Input MSB
9A90: 8D 33 BE 159      STA  VECTIN+1
9A93: A5 38 160      LDA  KSWL      ;Input LSB
9A95: 8D 32 BE 161      STA  VECTIN
9A98: A5 37 162      LDA  CSWL+1      ;Output MSB
9A9A: 8D 31 BE 163      STA  VECTOUT+1
9A9D: A5 36 164      LDA  CSWL      ;Output LSB
9A9F: 8D 30 BE 165      STA  VECTOUT
9AA2: 68 166      PLA
167
* Put Intercepts Into CSW/KSW [same]
168
9AA3: 48 170      SETINCPT PHA
9AA4: AD 34 BE 171      LDA  VDOSIO      ;Output LSB
9AA7: 85 36 172      STA  CSWL
9AA9: AD 35 BE 173      LDA  VDOSIO+1      ;Output MSB
9AAC: 85 37 174      STA  CSWL+1
9AAE: AD 36 BE 175      LDA  VDOSIO+2      ;Input LSB
9AB1: 85 38 176      STA  KSWL
9AB3: AD 37 BE 177      LDA  VDOSIO+3      ;Input MSB
9AB6: 85 39 178      STA  KSWL+1
9AB8: 68 179      PLA
9AB9: 60 180      RTS
181
* STATE D Output Handler (Check CTL-D) [$9DD2]
182
183
184      ORG  $9DA3
185
186
* Check CTL-D after PRINT token
187
9DA3: 20 62 9F 188      VSTATED JSR  REGSAV      ;Save A,X,Y
9DA6: C9 84 189      CMP  #ctld
9DA8: D0 17 190      BNE  1      ;CTL-D not found
191
* CTL-D found so prepare to assemble command line
192

```

continued on next page



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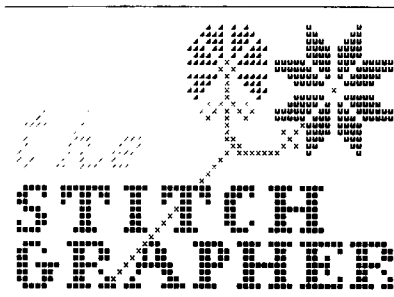
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LISTING 1: BI Output Processing (continued)

```

9DAA: 20 F4 9F 193
9DAD: 8D 4B BE 194
9DB0: 8D 44 BE 196
9DB3: 8D 45 BE 197
9DB6: 8D 46 BE 198
9DB9: A2 08 199
9DBB: 20 76 9F 200
9DBE: 4C 6C 9F 201
202
203
204
9DC1: A2 04 205
9DC3: 20 76 9F 206
9DC6: 20 6C 9F 207
9DC9: 4C F1 B7 208
209
210
211
212
213
9DCC: 20 62 9F 214
9DCF: AE 4B BE 215
9DD2: 9D 00 02 216
9DD5: C9 8D 217
9DD7: F0 0E 218
219
220
221
9DD9: EE 4B BE 222
9DDC: D0 05 223
9DDE: A9 10 224
9DE0: 4C EE 9A 225
9DE3: AE 3F BE 226
9DE6: 60 227
228
229
230
9DE7: E8 231
9DE8: CA 232
9DE9: F0 0B 233
9DEB: 20 00 9A 234
9DEE: 20 77 A6 235
9DF1: B0 ED 236
9DF3: 20 8D 9A 237
9DF6: A2 04 238
9DF8: 20 76 9F 239
9DFB: 4C 6C 9F 240
241
242
243
244
245
9DFE: 8C 40 BE 246
9E01: A4 33 247
9E03: F0 0C 248
9E05: 88 249
9E06: F0 09 250
9E08: 88 251
9E09: F0 06 252
9E0B: AC 40 BE 253
9E0E: 4C 74 9A 254
255
256
257
258
259
9E11: AC 4A BE 260
9E14: 29 7F 261
9E16: 91 73 262
9E18: AC 40 BE 263
9E1B: EE 4A BE 264
9E1E: D0 0B 265
266
267
268
9E20: 20 62 9F 269
9E23: 20 EE 9F 270
9E26: B0 B8 271
9E28: 20 6C 9F 272
9E2B: 60 273
274
275
276
277
278
9E2C: CD 61 9F 279
9E2F: D0 18 280
9E31: 8E 3F BE 281
9E34: BA 282
9E35: BD 03 01 283
9E38: C9 12 284
9E3A: D0 07 285
9E3C: BD 04 01 286
9E3F: C9 D8 287
9E41: F0 73 288

JSR WRBUFDA1 ;Write buffered data
STA INPTR ;Set at start of command line
STA IFILACTV ;Set file input inactive
STA OFILACTV ;Set file output inactive
STA PFXACTV ;Set prefix input inactive
LDX #8
JSR SETSTATE ;Set STATE 8
JMP REGRST ;Restore A,X,Y

* CTL-D not found so return to deferred mode:
:1 LDX #4
JSR SETSTATE ;Set STATE 4
JSR REGRST ;Restore A,X,Y
JMP DOSOUT ;Output the char

* STATE 8 Output Handler (Assemble Command Line) [$9DFB]:
* Save char in command line buffer (INBUF):
VSTATE8 JSR REGSAV ;Save A,X,Y
LDX INPTR ;Set index to command line
STA INBUF,X ;Save char in command line
CMP #cr
BEQ V8CREX ;CR found

* Line not completed:
INC INPTR ;Bump index
BNE V8NOCREX ;Go to exit
LDA #10 ;Set for SYNTAX ERROR
GOERROR2 JMP ERROR ;Go to error handler
V8NOCREX LDX PREGX
RTS

* Line completed (CR found):
V8CREX INX
DEX
BEQ :1 ;Empty line found
JSR SETIOTRU ;Set true I/O handlers
JSR SYNTAX ;Process command line
BCS GOERROR2 ;Error
JSR SAVIOTRU ;Restore intercepts
:1 LDX #4 ;Processing completed so
JSR SETSTATE ; set STATE 4
JMP REGRST ;Restore A,X,Y

* Write Character to Temporary Buffer [$9E2D]:
* Check for desired Applesoft token:
WRTBFCHR STY PREGY ;Save Y
LDY PROMPT
BEQ :1 ;PRINT or IF (prompt=0)
DEY
BEQ :1 ;LIST (prompt=1)
DEY
BEQ :1 ;CALL (prompt=2)
LDY PREGY ;Restore Y
JMP CHAROUT ;Echo char

* PRINT, IF, LIST or CALL Applesoft token found:
* -> Store character in temporary buffer:
:1 LDY TBUFPTR ;Get index to buffer
AND #7F ;Convert char to pos ASCII
STA (MEMSIZ),Y ;Store char in buffer
LDY PREGY ;Restore Y
INC TBUFPTR ;Bump buffer index and exit if
BNE RTS3 ; buffer not full (256 bytes)

* -> Write full buffer to disk:
JSR REGSAV ;Save A,X,Y
JSR WRBUFDAT ;Write buffer to disk
BCS GOERROR2 ;Error
JSR REGRST ;Restore A,X,Y
RTS3 RTS

* STATE 4 Output Handler [$9E5B]:
* Check if Applesoft is tracing:
VSTATE4 CMP TRACECHR ;Site of THEN FLASH patch
BNE :2 ;Trace char not being output
STX PREGX ;Save entry X
TSX
LDA STACK+3,X ;Check stack for Apsoft
CMP #OUTRACE+2 ; trace printing
BNE :1 ;Not trace printing
LDA STACK+4,X
CMP #>OUTRACE+2
BEQ BITRACE1 ;Trace printing active

```

```

289
290 * Applesoft not tracing. Check file output activity:
291
9E43: AD 61 9F 292 :1 LDA TRACECHR ;Restore entry A
9E46: AE 3F BE 293 LDX PREGX ;Restore entry X
9E49: 2C 45 BE 294 :2 BIT OFILACTV
9E4C: 10 1E 295 BPL :4 ;File output not active
296
297 * File output active:
298
299 * -> Check Applesoft prompt character:
300
9E4E: C9 DD 301 CMP #"]"
9E50: D0 04 302 BNE :3 ;] not being output
9E52: C5 33 303 CMP PROMPT ;If Appsoft prompt being
9E54: F0 30 304 BEQ :6 ; output, check open files
305
306 * -> Check CR:
307
9E56: C9 8D 308 :3 CMP #cr ;If CR not being output, write
9E58: D0 A4 309 BNE WRTBFCHR ; char to temporary buffer
310
311 * -> CR being output:
312
9E5A: A5 33 313 LDA PROMPT ;If prompt is -1 ($FF). 2nd
9E5C: C9 FF 314 CMP #-1 ; consecutive CR being output
9E5E: A9 8D 315 LDA #cr ;Restore A
9E60: 90 9C 316 BCC WRTBFCHR ;Write 1st CR
9E62: 20 F4 9F 317 JSR WRBUFDAL ;In case of error flush buffer
9E65: 8D 45 BE 318 STA OFILACTV ; & flag file output inactive
9E68: A9 8D 319 LDA #cr ;Restore A
9E6A: D0 33 320 BNE :8 ;Always output 2nd CR to device
321
322 * File output not active. Check active
323 * file input and/or prefix input:
324
9E6C: 48 325 :4 PHA
9E6D: AD 44 BE 326 LDA IFILACTV ;Test active file input
9E70: 0D 46 BE 327 ORA PFXACTV ;Test active prefix input
9E73: 10 08 328 BPL :5 ;File/prefix input inactive
329
330 * File input and/or prefix input active:
331
9E75: A5 33 332 LDA PROMPT
9E77: 09 04 333 ORA #4
9E79: C9 84 334 CMP #input ;If INPUT token found,
9E7B: F0 25 335 BEQ :9 ; suppress echo of prompt
336
337 * Check Applesoft prompt character:
338
9E7D: 68 339 :5 PLA
9E7E: C9 DD 340 CMP #"]" ;If char is not ],
9E80: D0 1D 341 BNE :8 ; echo char
9E82: C5 33 342 CMP PROMPT ;If char is ] but ] is not
9E84: D0 19 343 BNE :8 ; prompt, echo char
344
345 * Applesoft immediate mode prompt being output.
346
347 * -> Check open file(s):
348
9E86: 20 62 9F 349 :6 JSR REGSAV ;Save A,X,Y
9E89: AD 40 BE 350 LDA OPENCNT
9E8C: F0 0E 351 BEQ :7 ;None open so echo char
352
353 * -> File(s) open.
354
9E8E: 20 F4 9F 355 JSR WRBUFDAL ;Write data to buffer
9E91: 8D 45 BE 356 STA OFILACTV ;Set output file inactive
9E94: 20 00 9A 357 JSR SETIOTRU ;Set true I/O handlers
9E97: A9 15 358 LDA #$15
9E99: 20 0C BE 359 JSR PRINTERR ;Print FILE(S) STILL OPEN
360
361 * Echo output character:
362
9E9C: 20 6C 9F 363 :7 JSR REGRST ;Restore A,X,Y
9E9F: 4C 74 9A 364 :8 JMP CHAROUT ;Echo output char
365
366 * No echo exit:
367
9EA2: 68 368 :9 PLA
9EA3: C9 8D 369 CMP #cr
9EA5: D0 03 370 BNE :10 ;CR not found
9EA7: CD 4C BE 371 CMP CHRLAST ;Prior char CR?
9EA8: 8D 4C BE 372 STA CHRLAST ;Remember present char
9EAD: D0 02 373 BNE RTS4
9EAF: 85 33 374 STA PROMPT ;Flag consecutive CRs
9EB1: 60 375 RTS4 RTS
376
377 * BI Trace Processing [$9EE1].
378
379 * Bump Applesoft text pointer:
380
9EB2: E6 B9 381 BITRACE INC TXTPTR+1
9EB4: D0 04 382 BNE BITRACE2
9EB6: E6 B8 383 BITRACE1 INC TXTPTR
9EB8: F0 F8 384 BEQ BITRACE
385

```

continued on page 124

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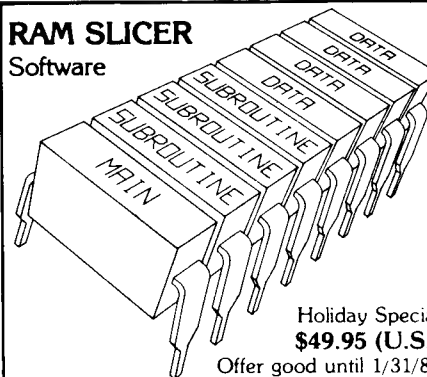
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not cleared.

RESUME Token — Lines 487-490 clear the Applesoft ONERR code, restore the token to the Accumulator and branch to an Applesoft entry vector.

INVERSE and NORMAL Tokens — Lines 513-514 stuff the pound sign into the trace character image, and lines 515-516 restore the token to the Accumulator and reenter Applesoft BASIC.

FLASH Token — When the FLASH token is found, the value \$E3 is stored in the image of the trace character (lines 508-509). The rationale can be found in OUTDO at line 118 of Listing 2. When FLASH mode is active, ORMASK holds the value \$40 (lines 180-182 of Listing 2), and the pound sign is ORed with \$40 and becomes \$E3. Whenever OUTDO is called to print the trace character with FLASH in effect, the trace character is represented by \$E3 rather than \$A3. For the tests at lines 88 and 279 to remain valid under this circumstance, the trace character image must now contain \$E3. Please remember this theory for future reference.

STATE D

The sole purpose of STATE D is to search for <CTRL>D following a PRINT token. If the DOS alert character is not found (line 190), STATE 4 is reset (lines 205-206) and VSTATE4 is accessed (line 208). If <CTRL>D is located, a BI command is pending, in which case the temporary buffer is cleared, the command line index is zeroed, file/prefix I/O flags are cleared, and STATE 8 is activated (lines 194-200).

STATE 8

When a BI command has been identified, VSTATE8 assembles the command in the input buffer where it can be validated and processed. INPTR (line 215) holds the buffer position, and line 216 stores the command character in the input buffer. If the end of the command (i.e., a CR) is not found, INPTR is incremented (line 222) and the routine is exited (lines 226-227). If the command line contains more than 256 characters, lines 224-225 produce a SYNTAX ERROR message. On completion of the command (line 218), flow passes to lines 231-232, where a noncommand (i.e., <CTRL>D followed by no command) is ignored (line 233) or a pending command is processed (line 235). Following command execution, a set carry indicates an error condition (line 236). On Carry Clear, STATE 4 is reinstated (lines 238-239).

FILE OUTPUT

When a file is being written, some output is directed to the file itself (e.g., after PRINT statements) and some output goes to

the screen or printer. If a PRINT, CALL or LIST token is found (these were flagged by BITRACE when special tokens were processed) (lines 247-252), output is held in the temporary (general purpose) buffer; otherwise, the character is echoed (line 254). Buffered characters are stored in positive ASCII format (lines 260-262). When the buffer contains 256 bytes, it is written to disk (lines 269-273).

WRBUFDAT does the actual writing. If entered at line 529, 256 bytes are copied from the temporary buffer to disk. Entry at line 535 writes the number of bytes in the A and Y Registers to disk and handles errors. Entry at line 545 flushes the buffer (TBUFPtr holds the number of stored bytes) to disk. Lines 548-551 set the WRITE parameter list for the correct number of bytes to be written and call GOSYSTEM, the BI global page subroutine that handles calls to the machine language interface. After resetting TBUFPtr to zero (lines 553-554), the subroutine exits with a zero in the Accumulator. As usual, a set carry flags an error.

TRACING AN ELUSIVE BUG

Since the inception of ProDOS, I and others have noted a strange bug in the trace mechanism. An Applesoft program might be functioning well when, all of a sudden, without any apparent rhyme or reason, tracing would be activated for a brief period of time and then would stop as inexplicably as it started. This occurred without a single TRACE command found in the resident program. The addition of NOTRACE would not abolish the aberration. Strange!

As I embarked upon writing this installment of D.L., I resolved that I would root out the bug. First, however, the problem had to be defined. Fortuitously, in the April 1985 issue of *Nibble* (Vol. 6/No. 4), a letter to the editor from J.R. Wakefield presented a short program called FLASHER that illustrated this very bug. It looked like this:

```
10 GET A$ PRINT
20 IF A$ = "A" THEN FLASH PRINT "
   ERROR" GOTO 40
30 FLASH PRINT "OK"
40 NORMAL GOTO 10
```

The four-liner contains no TRACE command, yet tracing occurs whenever the upper-case A is entered. It is apparent that should the IF condition (line 20) be satisfied, the combination of THEN and FLASH turns on tracing. When the NORMAL statement is executed, tracing stops. Experimenting confirms the culpability of this nefarious coalition of keywords. The suggestion by the editor to use POKE 50,127 instead of FLASH was valid, but I was not about to walk away with my tail between my legs. No sirree!

In debugging, I use several techniques. If looking at code does not solve my problem, I use the "bell" technique to test various

segments (this is explained below). When all else fails, I use BUGBYTER, the debugger on the ProDOS Assembler Tools disk. I used this superb debugger long before Apple Computer purchased it from Computer Advanced Ideas.

After racking my brain for a good hour, I could find no apparent flaw in the STATE handlers or BI trace handler. I theorized that the problem must reside in the interaction between Applesoft and ProDOS BASIC.

My next step was to see how the FLASH token was processed by the BI. The bell method is a simple debugging trick: you place a call to the bell routine in a segment of code. The bell will sound if program flow passes through the target area. I entered the System Monitor (CALL -151) and made the following patches (BI 1.0 addresses are in brackets):

```
9F54 4C 4C BB JMP $B84C [9F83 4C BA BB]
BB4C 20 3A FF JSR BELL [BBBA 20 3A FF]
A9 E3 LDA #$E3 [A9 E3]
4C 5A 9F JMP $9F5A [4C 89 9F]
```

\$B84C-\$BC79 is an unused space within BI version 1.1 (\$BBBA-\$BC77 is free in version 1.0). This code merely provides a bell sound whenever the BI processes the FLASH token (lines 508-509 and 514-515 of Listing 1).

I reentered BASIC and again ran FLASHER. To my delight, the bell rang (i.e., FLASH was processed by the BI) when any key but A was pressed, but no sound was heard when the IF-THEN statement was evaluated as true (i.e., A was pressed). This proved that the FLASH in line 30 was handled normally, but the same token in line 20 was ignored by the BI. Very interesting.

Apparently, a true IF THEN construction caused a token following THEN to bypass the BI. I tested this hypothesis using the following program:

```
100 D$ = CHR$(4)
110 ONERR GOTO 500
120 PRINT D$ "DELETE TESTFILE"
130 PRINT PEEK(222) END
500 PRINT D$ "CREATE TESTFILE"
510 IF NOT B THEN RESUME
```

For the program to function properly, TESTFILE cannot be a file on your disk. When line 120 is executed, TESTFILE is not found and ONERR flips control to line 500, where TESTFILE is created. The RESUME statement passes flow back to the point at which the error occurred (i.e. line 120). When Applesoft processes RESUME, the error code location (\$DE = 222) is not cleared. When the BI preprocesses RESUME, however, this location is zeroed (lines 487-488 of Listing 1). Thus, if the BI gets hold of RESUME, line 130 prints a zero before ending. If the BI fails to process RESUME, error number 6 (FILE NOT FOUND) is output. It all hinges on whether a true IF-THEN complex will skip RESUME, as it apparently did with FLASH in

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the Wakefield program. By the way, the Boolean "NOT B" (line 510) evaluates as true because all undefined variables are assigned a zero value, which goes to show that things do sometimes go your way. Indeed, on running the program, RESUME is never handled by the BI, as evidenced by the "6" on the screen. Removing the IF-THEN statement in line 510 (i.e., simply having RESUME) produces the expected zero in location 222.

The success of the above test sent me poring through my disassembly of Applesoft ROM for the mechanism of the IF-THEN function. I searched the Applesoft command table for THEN but learned that no handler exists for this token. The IF statement handler is disassembled in lines 131-150 of Listing 2. After evaluating the formula after IF (line 131), the character following the formula is obtained (line 132). If GOTO is found, flow drops to line 137. If THEN is found by the subroutine SYNCHR (lines 135-136), flow resumes at line 137. If neither GOTO nor THEN is encountered, SYNCHR produces the appropriate error message.

At lines 137-138, if the floating-point accumulator (FAC) is zero, the IF-THEN statement was false and the remainder of the line is bypassed (lines 142-143). When IF-THEN is true, flow passes to line 147, which fetches the character following THEN or GOTO. CHRGET exits with a clear carry if a decimal digit is found or a set carry if a nondigit is picked. On finding a numeral, GOTO is inferred and control passes to the GOTO handler (line 149). Upon locating a nondigit, flow is routed to TYPSTT (line 92), the portion of NEWSTT that accesses the statement handler.

As a result of this process, any token immediately following THEN bypasses EXECUTE/GETSTT (lines 75-78), is not trapped by OUTRACE, and does not reach the BI. Quite fascinating, don't you think?

We have not yet explained why THEN-FLASH turns on trace mode, but we're sneaking up on it. If FLASH (following THEN) fails to be processed by the BI, the value \$E3 is not placed into TRACECHR, but Applesoft still conditions ORMASK and INVFLG (lines 174-182). When deferred mode output next reaches OUTRACE, OUTDO uses ORMASK to convert the pound sign (value \$A3) to value \$E3. Since TRACECHR has not been changed from \$A3 to \$E3 by the BI trace processor, when VSTATE4 is reached, the branch in line 280 of Listing 1 is taken. The trace character (value \$E3 ANDed by COUT) with value \$7F equal to a flashing pound sign) is eventually output (branches are taken at lines 295, 328 and 341) by CHAROUT (line 364). Applesoft regains control at line 82 of Listing 2, where the line number is printed. Not until FLASH is disabled by NORMAL or INVERSE or until FLASH is

LISTING 1: BI Output Processing (continued)

```

386 * Set prompt for possible error detection in VSTATE4.
387
9EBA A2 FF 388 BITRACE2 LDX #-1 ;If PROMPT remains -1 then
9EBC 86 33 389 STX PROMPT ;consecutive nontokens found
390
391 * Restore Applesoft NEWSTT stack pointer
392
9EBE A6 F8 393 LDX REMSTK
9EC0 9A 394 TXS
395
396 * Check if BI trace active:
397
9EC1 2C 41 BE 398 BIT DTRACE
9EC4 30 73 399 BMI DOTRACE ;BI trace active
400
401 * Get Applesoft program character.
402
9EC6 A0 00 403 NXTASCHR LDY #0
9EC8 B1 B8 404 LDA (TXTPTR),Y ;Get char
9ECA 30 25 405 BMI CHKTKN ;Token found
9ECC F0 20 406 BEQ GOGETST2 ;End of line found
407
408 * Check possible garbage collection:
409
9ECE CE 49 BE 410 TRCFRE DEC STRINGS ;Decrement counter
9ED1 D0 19 411 BNE GOGETST1 ;If counter zero skip garbage
9ED3 A5 70 412 LDA FRETOP+1 ;Calculate
9ED5 E5 6E 413 SBC STREND+1 ;free space
9ED7 C9 03 414 CMP #3 ;If 3 pages or more.
9ED9 B0 0A 415 BCS :1 ;no problem.
9EDB 20 F4 9F 416 JSR WRBUFDA1 ;else write data to buffer
9EDE 20 44 A0 417 JSR FRECMD ;and collect garbage
9EE1 A5 70 418 LDA FRETOP+1 ;and recalculate
9EE3 E5 6E 419 SBC STREND+1 ;free space
9EE5 8D 49 BE 420 :1 STA STRINGS ;Save new count
421
422 * Get Applesoft program character again:
423
9EE8 A0 00 424 LDY #0
9EEA B1 B8 425 LDA (TXTPTR),Y ;Get char
426
427 * Execute Applesoft statement
428
9EEC C9 3A 429 GOGETST1 CMP #'.' ;Condition status flags
9EEE 4C 20 D8 430 GOGETST2 JMP GETSTT+3 ;Execute statement (token)
431
432 * Process token
433
434 * -> Check token us ng (gaspl) self-modifying code
435
9EF1 85 33 436 CHKTKN STA PROMPT ;Store token in PROMPT and
9EF3 A8 437 TAY ;use as lookup index to
9EF4 B9 99 B7 438 LDA APTKNTBL-$80,Y ;Applesoft Token Table
9EF7 30 F5 439 BMI GOGETST2 ;Ord nary token so execute
9EF9 8D FD 9E 440 STA :+1 ;Special token Set handler
9EFC D0 00 441 :1 BNE BPRINT ;Branch set by prior line
442
443 * -> PRINT or IF token
444
445 BIF
446 BPRINT STA PROMPT ;PROMPT=0
447 STA CHRLAST ;Write out last char
448 LDA STATED ;Set STATE D to check for
449 STA VSYSIO ;CTL-D after PRINT token
450 LDA STATED+1
451 STA VSYSIO+1
452 BNE GOGETST3 ;Always
453
454 * -> LIST token
455
9F11 A9 01 456 BLIST LDA #1
9F13 85 33 457 STA PROMPT ;PROMPT=1
9F15 D0 17 458 BNE GOGETST3 ;Always
459
460 * -> CALL token
461
9F17 A9 02 462 BCALL LDA #2
9F19 85 33 463 STA PROMPT ;PROMPT=2
9F1B D0 11 464 BNE GOGETST3 ;Always
465
466 * -> LET token (forces check for garbage collection)
467
9F1D 98 468 BLET TYA ;Put token in A
9F1E 4C CE 9E 469 JMP TRCFRE
470
471 * -> TRACE token
472
9F21 8C 41 BE 473 BTRACE STY DTRACE ;Set BI trace flag
9F24 D0 04 474 BNE SETASTRC ;Always
475
476 * -> NOTRACE token
477
9F26 8D 41 BE 478 BNOTRACE STA DTRACE ;Clear BI trace flag
9F29 88 479 DEY ;Change NOTRACE to TRACE
9F2A A9 4A 480 SETASTRC LDA #$4A ;Set Apsoft trace flag (TRACE
9F2C 85 F2 481 STA TRCFLG ;handler will ROR to $A5)

```

continued on page 126

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processed by the BI will the trace anomaly be corrected.

RIGHTING THE WRONGS

Having identified the trace bug, I set out to exterminate it. I turned off my //e, donned my thinking cap, and stretched out in my usual horizontal working position with a pad and pencil. During the composition of this article, I had a gut feeling that the trace character image (line 521 of Listing 1) was unnecessary. After all, if we prove that STATE 4 (or STATE 0) flow comes from OUTRACE, the character in the Accumulator must be either the trace character proper (\$A3) or, in FLASH mode, the pound sign ORED with \$40 (\$E3). This being the case, why test for the trace character at all? Instead, why not simply test for OUTRACE activity? If found, program flow passes to BITRACE1 (line 383 of Listing 1); if not found, it continues processing through VSTATE4.

Listing 3 patches the beginning of VSTATE4 to do just that. Lines 23-29 install the patch when FLASH.PATCH is executed. The actual patch starts by saving the entry Accumulator contents on the stack (line 37) and the entry X in the global page (line 38). As in the original code, a check is now made for OUTRACE output (lines 39-45). Note that we must search one byte deeper into the stack because of the PHA instruction in line 37. If output does not originate at OUTRACE (lines 42 and 45), flow branches to line 48, where the entry Accumulator is restored and three NOP bytes are used as fillers. Flow drops to line 293 of Listing 1, where the entry X-Register is restored and STATE 4 handling continues. OUTRACE activity is routed to BITRACE1 via lines 46-47.

To install the patch temporarily, use your assembler to enter Listing 3 in its entirety. If you don't have an assembler, enter the Monitor with CALL -151. Then key in the code as one continuous block starting at \$8000, ignoring the second origin at line 35 and its resulting change in addresses. Save the program with the command:
BSAVE FLASH.PATCH,A\$8000,L\$28

Installing the patch is then a simple matter of entering the command:

-FLASH.PATCH

To make the fix permanent, type:

BLOAD BASIC.SYSTEM,TSYS,A\$2000

Enter the Monitor (CALL -151), type the actual patch (lines 37-49 of Listing 3) into locations \$282C-\$2845, and type:

BSAVE BASIC.SYSTEM,TSYS,A\$2000,L\$2800

Note that the entry addresses and the final addresses in the PRODOS system file are different, although the low bytes correspond. If you are installing this patch in BI Version 1.0, start entering the code at

LISTING 1: BI Output Processing (continued)

```

9F2E: 98      482  GOGETST3 TYA      ;Put token in A
9F2F: 4C 20 D8 483      JMP      GETSTT+3 ;Execute Apsoft statement
      484
      485
      486
      487
      488
      489
      490
      491
      492
      493
9F32: A9 00      494  BRESUME LDA #0
9F34: 85 DE      488      STA ERRNUM ;Clear Apsoft error code
9F36: 98      489      TYA      ;Put token in A
9F37: D0 B3      490      BNE GOGETST1 ;Always
      491
      492
      493
      494
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      496
      497
      498
      499
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      501
      502
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      504
      505
      506
      507
9F54: A9 E3      508  BFLASH LDA #".$.40
9F56: D0 02      509      BNE FLS1 ;Always
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      566
      567
      568
      569
      570
      571
      572
      573
      574
      575
      576
      577
9F61: A3      521  TRACECHR ASC #" ;Trace char
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      576
      577
9FEE: A9 00      529  WRBUFDAT LDA #0
9FF0: A0 01      530      LDY #1 ;$100 bytes to write
9FF2: D0 13      531      BNE WRBUFDA3 ;Always
      532
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      577
A000: A0 00      545  WRBUFDA2 LDY #0
A002: AD 4A BE      546      LDA TBUFPTR ;Get data count (<256)
A005: F0 14      547      BEQ CLCRTS1 ;No data found
A007: 8D D9 BE      548  WRBUFDA3 STA RWCOUNT ;Set # bytes to write
A00A: 8C DA BE      549      STY RWCOUNT+1 ; in WRITE parmlist
A00D: A9 CB      550      LDA #WRITE
A00F: 20 70 BE      551      JSR GOSYSTEM ;WRITE call
A012: 48      552      PHA ;Save error code
A013: A9 00      553      LDA #0
A015: 8D 4A BE      554      STA TBUFPTR ;Zero buffered data count
A018: 68      555      PLA ;Restore error code
A019: 80 01      556      BCS RTS6 ;CS=error
A01B: 18      557  CLCRTS1 CLC ;CC=no error
A01C: 60      558  RTS6 RTS
      559
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      577
B819: 80 81 82      569  APTKNTBL HEX 808182 ;end, for, next
B81C: 83 84 85      570      HEX 838485 ;data, input, del
B81F: 86 87 88      571      HEX 868788 ;dim, read, gr
B822: 89 8A 8B      572      HEX 898A8B ;text, pr#, in#
B825: 19 8D 8E      573      HEX 198D8E ;CALL, plot hlin
B828: 8F 90 91      574      HEX 8F9091 ;vlin, hgr2, hgr
B82B: 92 93 94      575      HEX 929394 ;hcolor=, hplot, draw
B82E: 95 96 97      576      HEX 959697 ;xdraw, htab, home
B831: 98 99 9A      577      HEX 98999A ;rot=, scale=, shload

```

```

B834: 23 28 5A 578      HEX 23285A      ;TRACE, NOTRACE, NORMAL
B837: 5A 56 A0 579      HEX 5A56A0      ;INVERSE, FLASH, color=
B83A: A1 A2 A3 580      HEX A1A2A3      ;pop, vtab, himem:
B83D: A4 A5 34 581      HEX A4A534      ;lomem:, onerr. RESUME
B840: A7 A8 A9 582      HEX A7A8A9      ;recall, store, speed=
B843: 1F AB AC 583      HEX 1FABAC      ;LET, goto, run
B846: 00 AE AF 584      HEX 00AEAF      ;IF, restore, &
B849: B0 B1 B2 585      HEX B0B1B2      ;gosub, return, rem
B84C: B3 B4 B5 586      HEX B3B4B5      ;stop, on, wait
B84F: B6 B7 B8 587      HEX B6B7B8      ;load, save def
B852: B9 00 BB 588      HEX B900BB      ;poke, PRINT, cont
B855: 13 BD BE 589      HEX 13BDBE      ;LIST, clear, get
B858: BF          590      HEX BF          ;new

```

--End assembly, 697 bytes, Errors: 0

END OF LISTING 1

LISTING 2: Applesoft ROM Routines

Note: Don't enter this code. It already exists in Applesoft ROM.

```

1  *****
2  *
3  *      Applesoft ROM Routines
4  *
5  *      Interpreted by Sandy Mossberg
6  *
7  *****
8
9  * Merlin-Pro Assembler
10
11 INVFLG = $32      ;Character output mask
12 CURLIN = $75      ;Current line#
13 OLDTEXT = $79      ;Save TXTPTR
14 FAC = $9D         ;Floating point accumulator
15 CHRGET = $B1      ;Bump TXTPTR and get char
16 CHRGTOT = $B7      ;Get char at TXTPTR
17 TXTPTR = $B8      ;Text pointer
18 SPOBYT = $F1      ;SPEED value
19 TRCFLG = $F2      ;Trace flag
20 ORMASK = $F3      ;FLASH mask
21 REMSTK = $F8      ;Save stack pointer
22 CMDTBL = $D000     ;Statement command table
23 RTNI = $D857      ;RTS instruction
24 ISCNCT = $D858     ;Check for CTL-C
25 GOCMDLP = $D88A    ;Go to CMDLP if carry clear
26 GOTOCMD = $D93E    ;GOTO command
27 ADDON = $D998     ;Add (Y) to TXTPTR
28 REMN = $D9A6      ;Find EOL
29 FRMEVL = $D9C9     ;Evaluate formula at TXTPTR
30 LETCMD = $DA46     ;LET statement
31 OUTSP = $DB57      ;Output space
32 SYNCHR = $DEC0     ;Assure TXTPTR = (A)
33 SYNERR = $DEC9     ;Print ?SYNTAX ERROR
34 LINPRT = $ED24     ;Print decimal of (A.X)
35 WAIT = $FCA8      ;Delay
36 COUT = $FDED      ;Output char
37
38 goto = $AB        ;GOTO token
39 then = $C4        ;THEN token
40
41 *-----*
42 * New Statement Handler:
43 *-----*
44      ORG $D7D2
45
46 NEWSTT TSX          ;Save stackpointer
47      STX REMSTK
48      JSR ISCNCT     ;Check CTL-C abortion
49      LDA TXTPTR     ;Prepare to save TXTPTR
50      LDY TXTPTR+1
51      LDX CURLIN+1   ;Immediate mode ($FF in
52      INX             ;CURLIN hi)?
53      BEQ CKEND      ;Yes
54      STA OLDTEXT    ;No. Save TXTPTR
55      STY OLDTEXT+1
56      LDY #0
57      LDA (TXTPTR),Y ;Check byte at TXTPTR
58      BNE EOS        ;Nonzero. Should be EOS
59      LDY #2         ;Zero. Check absolute or
60      LDA (TXTPTR),Y ;relative link byte hi
61      CLC
62      BEQ EOP        ;Zero. End program
63      INY            ;Nonzero. Deferred mode only
64      LDA (TXTPTR),Y
65      STA CURLIN     ;Line# lo
66      INY
67      LDA (TXTPTR),Y
68      STA CURLIN+1   ;Line# hi
69      TYA
70      ADC TXTPTR     ;Set TXTPTR to 1st char of
71      STA TXTPTR     ;line contents
72      BCC EXECUTE

```

continued on next page

\$285B. Also, note that this patch is only good for BI Versions 1.0 and 1.1. It will not be compatible with subsequent releases of the BASIC interpreter. Presumably, Apple will have the bug fixed by then.

This generic solution to the trace character problem has widespread implications. All BI code employing TRACECHR may now be eliminated. Special processing of NORMAL, INVERSE and FLASH tokens also becomes superfluous. The net result is cleaner, less convoluted BI code.

The nonprocessing of tokens (e.g., RESUME, TRACE, NOTRACE) following true IF-THEN statements will still be a problem. Although not within the scope of this article, a solution may be found by processing IF-THEN statements within the BI itself. It's not complicated.

Implementation of these ideas requires re-writing a bit of the BI code. When Apple Computer gets around to revising Version 1.1, I sincerely hope they take these ideas into consideration. If you detect a flaw in my reasoning, please embarrass me.

UPCOMING

The next installment of Disassembly Lines will look at validation and processing of BI commands. Subsequently, we shall begin dissecting individual commands.

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CIRCLE NUMBER 61

LISTING 2: Applesoft ROM Routines (continued)

```

D803: E6 B9 73 INC TXTPTR+1
D805: 24 F2 75 EXECUTE BIT TRCFLG ;Trace active?
D807: 10 14 76 BPL GETSTT ;No
D809: A6 76 77 LDX CURLIN+1 ;Yes
D80B: E8 78 INX
D80C: F0 0F 79 BEQ GETSTT ;Immediate mode. Skip trace
D80E: A9 23 80 LDA ;Deferred mode
D810: 20 57 DB 81 OUTRACE JSR OUTDO ;Print "#" (BI TRAPS THIS!)
D813: A6 75 82 LDX CURLIN
D815: A5 76 83 LDA CURLIN+1
D817: 20 24 ED 84 JSR LINPRT ;Print decimal line#
D81A: 20 57 DB 85 JSR OUTSP
D81D: 20 B1 00 86 GETSTT JSR CHRGET ;Get next char
D820: 20 28 D8 87 JSR TYPSTT ;Evaluate and process it
D823: 4C D2 D7 88 JMP NEWSTT ;Back for more
D826: F0 62 90 EOP BEQ GOCMDLP ;Route flow to CMDLP
D828: F0 2D 92 TYPSTT BEQ RTN1 ;Allow leading/trailing colon
D82A: E9 80 93 SBC #$80 ;Token or nontoken?
D82C: 90 11 94 BCC LETSTT ;Nontoken. Must be LET statement
D82E: C9 40 95 CMP #$40 ;Token
D830: B0 14 96 BCS GOSYNERR ;Syntax error if token > $BF
D832: 0A 97 ASL ;Double index to CMDTBL
D833: A8 98 TAY ;Transfer to (Y)
D834: B9 01 D0 99 LDA CMDTBL+1,Y
D837: 48 100 PHA ;Hi byte on stack
D838: B9 00 D0 101 LDA CMDTBL,Y
D83B: 48 102 PHA ;Lo byte on stack
D83C: 4C B1 00 103 JMP CHRGET ;Get next char then RTS-jump
D83F: 4C 46 DA 105 LETSTT JMP LETCMD ;Execute LET (assign) statement
D842: C9 3A 107 EOS CMP #' ' ;Colon?
D844: F0 BF 108 BEQ EXECUTE ;Yes. Process next statement
D846: 4C C9 DE 109 GOSYNERR JMP SYNERR ;No. Syntax error
110
111 * Output Character:
112
113 ORG $DB57
114
DB57: 09 80 115 OUTDO ORA #$80 ;Assure negative ASCII
DB59: C9 A0 116 CMP #$A0 ;Control char?
DB5B: 90 02 117 BCC PRCHR ;Yes. Print invisible char
DB5D: 05 F3 118 ORA ORMASK ;FLASH=$40. NORMAL/INVERSE=0
DB5F: 20 ED FD 119 PRCHR JSR COUT ;Output char
DB62: 29 7F 120 AND #$7F ;Convert to positive ASCII
DB64: 48 121 PHA ;Save on stack
DB65: A5 F1 122 LDA SPDBYT ;Fastest=1. Slowest=$FF
DB67: 20 A8 FC 123 JSR WAIT ;Delay
DB6A: 68 124 PLA ;Restore original char
DB6B: 60 125 RTS ;Back to caller
126
127 * IF Statement Handler:
128
129 ORG $D9C9
130
D9C9: 20 C9 D9 131 IFCMD JSR FRMEVL ;Evaluate formula after IF
D9CC: 20 B7 00 132 JSR CHRGOT ;Get char after formula
D9CF: C9 AB 133 CMP #goto
D9D1: F0 05 134 BEQ :1 ;GOTO found
D9D3: A9 C4 135 LDA #then
D9D5: 20 C0 DE 136 JSR SYNCHR ;Assure THEN found
D9D8: A5 9D 137 :1 LDA FAC
D9DA: D0 05 138 BNE IFTRU ;IF evaluates true
139
140 * REM (or False IF) Statement Handler:
141
D9DC: 20 A6 D9 142 REMCMD JSR REMN ;Skip remainder of line
D9DF: F0 B7 143 BEQ ADDON ;Always
144
145 * True IF Statement Handler:
146
D9E1: 20 B7 00 147 IFTRU JSR CHRGOT ;Get char after GOTO/THEN
D9E4: B0 03 148 BCS :1 ;Command (statement) found
D9E6: 4C 3E D9 149 JMP GOTOCMD ;Number found
D9E9: 4C 28 D8 150 JMP TYPSTT ;Execute command
151
152 * TRACE Statement Handler
153
154 ORG $F26D
155
F26D: 38 156 TRACECMD SEC
F26E: 90 157 HEX 90 ;Skip next byte
158
159 * NOTRACE Statement Handler.
160
F26F: 18 161 NOTRCCMD CLC
F270: 66 F2 162 ROR TRCFLG ;Shift carry into trace flag
F272: 60 163 RTS
164
165 * NORMAL Statement Handler.
166
F273: A9 FF 167 NORMCMD LDA #-1 ;Clear output mask
F275: D0 02 168 BNE NOFLASH ;Always

```

```

169 *-----
170 * INVERSE Statement Handler:
171 *-----
F277: A9 3F 172 INVCMD LDA #3F ;Set inverse output mask
F279: A2 00 173 NOFLASH LDX #0 ;Clear flash mask
F27B: 85 32 174 SETMASK STA INVFLG ;Set output mask
F27D: 86 F3 175 STX ORMASK ;Set flash mask
F27F: 60 176 RTS
177 *-----
178 * FLASH Statement Handler:
179 *-----
F280: A9 7F 180 FLASHCMD LDA #7F ;Set flashing output mask
F282: A2 40 181 LDX #40 ;Set flash mask
F284: D0 F5 182 BNE SETMASK ;Always

```

--End assembly, 200 bytes, Errors: 0

END OF LISTING 2

LISTING 3: FLASH.PATCH

See instructions to enter.

```

1 *****
2 * FLASH.PATCH *
3 * *
4 * Corrects THEN-FLASH bug in BI *
5 * [BI 1.1 addresses bracketed] *
6 * by Sandy Mossberg *
7 * Copyright (C) 1986 *
8 * by MicroSPARC, Inc. *
9 * Concord, MA 01742 *
10 *****
11
12 * Merlin-Pro Assembler
13
14 STACK = $100 ;Stack
15 BITRACE1 = $9EB6 ;BI trace processing [$9EE1]
16 PREGX = $BE3F ;Save X-reg [same]
17 OUTRACE = $D810 ;Trace char output
18
19 ORG $8000
20
21 * Move PATCH to BI:
22
23 8000: A2 00 24 MV1 LDA PATCH,X
25 8002: BD 0E 80 25 STA VSTATE4,X
26 8005: 9D 2C 8E 26 INX
27 8008: E8 26 27 CPX #PATCH1-PATCH
28 8009: E0 1A 28 BCC MV1
29 800B: 90 F5 29 RTS
30 800D: 60 29
31
32 * PATCH corrects THEN-FLASH bug:
33
34 PATCH = * ;Starting load address of patch
35
36 ORG $9E2C ;[$9E5B]
37
38 VSTATE4 PHA ;Save entry A
39 STX PREGX ;Save entry X
40 TSX ;Use stack pointer as offset
41 LDA STACK+4,X ;Check stack for Apsoft
42 CMP #OUTRACE+2 ; trace printing
43 BNE :1 ;Not trace printing
44 LDA STACK+5,X
45 CMP #>OUTRACE+2
46 BNE :1 ;Not trace printing
47 PLA ;Trace printing. Restore A
48 BCS BITRACE1 ;Always
49 :1 PLA ;Not trace printing. Restore A
50 HEX EAEAEA ;Filler NOP bytes
51 ORG ;Recall load address
52
53 PATCH1 = * ;Ending load address+1 of patch

```

--End assembly, 40 bytes, Errors: 0

END OF LISTING 3

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CIRCLE NUMBER 83

NIBBLE LIGHT PEN

by David Gauger, II

HARDWARE CONSTRUCTION PROJECT

Ten dollars worth of parts and a short machine language program are all you need to add this convenient accessory to your Apple. An Applesoft demonstration program illustrates techniques to use the light pen to select items from menus.

Most commercially available light pen systems use hardware to detect the location of the pen on the screen. This allows excellent resolution; some systems are even accurate to one pixel. They are also expensive, both in terms of hardware cost and system complexity, making them impractical for the average home user.

This article describes a light pen that is inexpensive and easy to construct. It uses just three active electronic parts that cost about \$10 and an ordinary ballpoint pen case. Despite its simplicity, the Nibble Light Pen is reliable and provides an effective, direct way to interact with any of the Apple // family computers. Like the mouse, the Nibble Light Pen lets you bypass the keyboard. Just point the light pen at the screen — you don't even need to "click."

The Nibble Light Pen consists of two basic elements: the light-sensing hardware and a machine language driver routine. Briefly, when the light pen detects the light from an inverse block on the screen, it transmits a pulse to one of the lines in the Apple // game port. This signals the driver routine to determine the screen position and

store the coordinates in memory. The calling program can then PEEK these memory locations to get the coordinates.

THE HARDWARE

Some hardware-based light pen systems use the time it takes for the monitor's electron beam to get from the bottom of the screen to the top to calculate the pen's location. Others interrupt the microprocessor when the pen detects the raster scan on a certain line. To keep the hardware simple, this system uses software to determine the pen's position. The hardware's sole function is to detect light.

The light pen is equipped with a photo-Darlington light detector. This is a sensitive but fairly inexpensive semiconductor that interfaces to the Apple // game port with the help of resistors.

There are three pushbutton inputs in the Apple // game port. Each one corresponds to a specific address in memory, and to a specific pin in the game port connector. When the light pen is pointed at a single inverse block, the photo-Darlington delivers about +1 volt to a pushbutton input. If the resulting voltage on that button's pin is +1 volt or more, a value of 128 (hex \$80) or greater is stored in the corresponding memory address. To see if the button has been "pushed" by the light pen, the pen software reads the location (address) of the

button. This is accomplished in BASIC by a PEEK statement.

Although it will work adequately without it, I added a variable resistor to the light pen. This component makes it possible to vary the light threshold level at which the photo-Darlington delivers +1 volt to the pushbutton input. It increases the circuit's sensitivity, allowing the pen to respond adequately to much dimmer light levels.

THE DRIVER

The software driver (Listing 1) is a short machine language routine that resides in memory page 3. It is designed to be used as a subroutine that can be CALLED by a machine language or BASIC program.

When CALLED, the driver searches every point on the screen for an inverse block. When it finds one, it determines whether this is the block at which the pen is pointing. If not, the routine looks for the next block. When the driver finds the correct block, it sounds a tone to notify the user, stores the vertical coordinate of the block in location 768 (hex \$300), stores the horizontal coordinate in location 769 (hex \$301), and returns to BASIC. From BASIC your main program can PEEK these two locations to find out where the pen is pointing.

CONSTRUCTION

To get the system up and running, con-

David Gauger, II, 1430 E. 55th Pl., Tulsa, OK, 74105. Nibble Light Pen is compatible with DOS 3.3 and ProDOS.

FIGURE 1: Schematic for Apple II, II Plus, and //e Light Pen (DIP Connector)
(Inset: Lead Diagram for Photo-Darlington [Sylvania ECG 3036 or Motorola MRD 360])

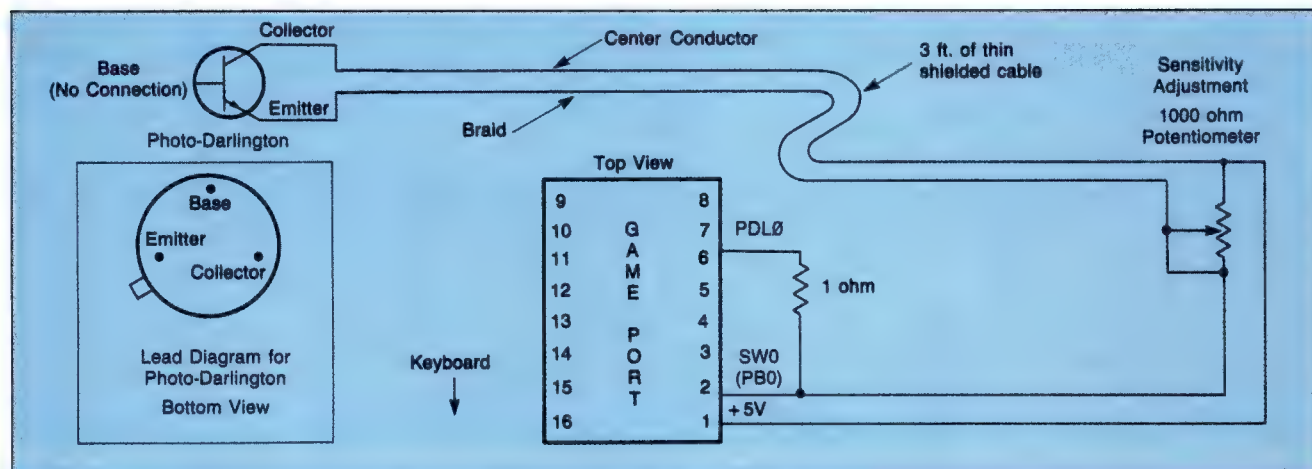
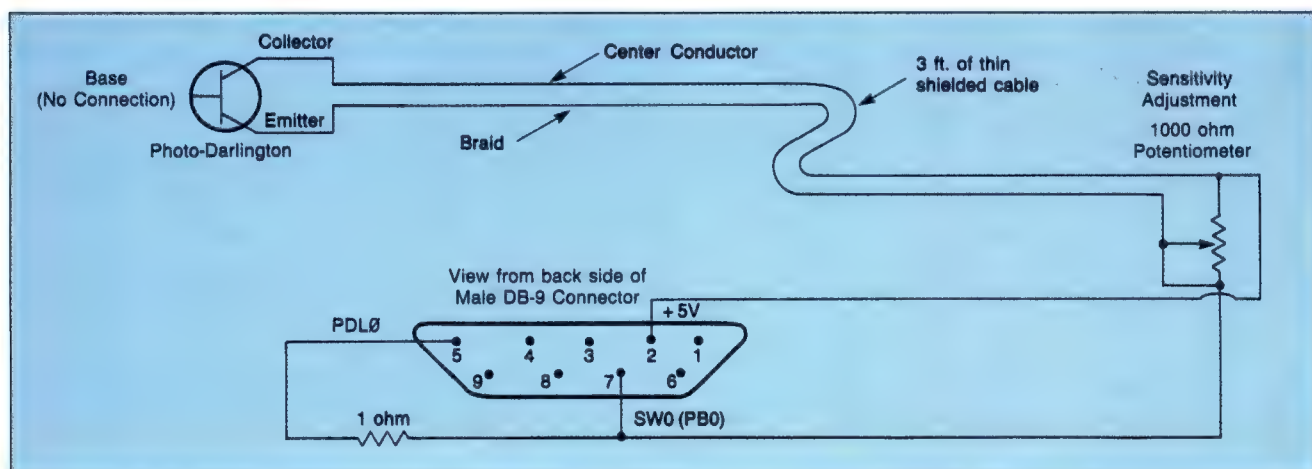


FIGURE 2: Schematic for Apple //c and //e Light Pen (DB Connector)



struct the light pen as shown in the diagram appropriate to your machine. If your computer uses a 16-pin DIP game socket (Apple II, II Plus or //e), then use the parts listed in Table 1, following the schematic diagram in Figure 1. Use Figure 2 and the parts in Table 2 if you have a //c or have equipped your machine with a DB-9 game socket. Next, type in the assembly listing (Listing 1), which is the same for all machines. If you do not have an assembler, consult the instructions in "A Welcome to New Nibble Readers" for help. Save the program to disk with the statement:

BSAVE PEN.DRIVER, A\$302,L\$8C

Any shielded cable may be used, but the more flexible it is, the easier the pen will be to manipulate. I used a disposable type of pen barrel to house the photo-Darlington, but anything that resembles a pen will do. Just be sure to feed the shielded cable down the center before you solder the light detector in place. Heat the leads of the photo-Darlington as little as possible, and mount it to provide close proximity to the screen (1/8 inch or less).

Any photo-Darlington may be used, provided it has adequate sensitivity for this

application. You may have difficulty finding one though, since photo-Darlington's are used almost exclusively in industrial applications, and electronics stores like Radio Shack do not carry them. An industrial electronics supply house should do the trick.

ADJUSTING THE LIGHT PEN'S SENSITIVITY

When the pen is constructed and the software has been loaded, use the following procedure to adjust the light pen's sensitivity. Set the brightness and contrast of the monitor to your liking. With the driver in memory, type in and run this short test program:

```
10 HOME
20 VTAB 10: HTAB 12
30 INVERSE
40 PRINT " ": NORMAL: REM 1 SPACE
50 CALL 770: REM LIGHT PEN DRIVER
60 PRINT PEEK(768)
70 PRINT PEEK(769)
```

The Apple responds by placing an inverse space on the screen. Note that this square of light is probably blinking or flickering. If it is not, try turning the variable resistor to one end or the other of its range. If you still cannot get it to flicker, there is probably

something wrong with the light pen or the driver software.

Turn the sensitivity adjustment to the end of its range so that the light blinks on and off very rapidly. The sensitivity is now at its lowest level. Turn the adjustment up until the light begins to flicker, then back it off slightly. The sensitivity is now at its highest, and the pen will respond to lower light levels from the screen. Touch the pen to the inverse space. The Apple should beep and then print a 9 above an 11. These are the coordinates of the block the driver found.

Set the sensitivity so that the light pen system locates the correct block every time. There should be a range of settings that make this possible. If the setting is too high or too low, the driver will sometimes return with the wrong block. The light pen system is now finished and ready to be used.

THE SOFTWARE

Because of the disjointed arrangement of text screen memory in the Apple, it is difficult to keep track of screen positions with simple row and column pointers. Fortunately, there is a built-in ROM routine called BASCALC that calculates the starting address of a screen row, given the number of

the row. Just place the row number in the Accumulator, execute BASCALC, and the address shows up in the addresses \$28 and \$29 (called BASL and BASH). An offset, representing the column position, completes the calculation of a screen memory location.

With BASCALC, it is possible to use two counters to keep track of the current text screen position. I use one counter to track the line number given to BASCALC (VCOUNT). The other, HCOUNT, is the offset value, which, in effect, is the horizontal counter. These are the two locations that you PEEK from BASIC to find out where the pen is pointing when the driver is called.

The Apple screen can accommodate 960 characters at one time. Obviously, checking for the light pen at all 960 character locations would be unnecessarily slow. A more efficient method would be to scan the screen for a pre-selected character. When scanning for a specific character, the driver would test perhaps 10 or 20 character locations for the light pen, instead of 960. Since the pen detects light, I chose to have it scan for the inverse space, which radiates a lot of light. However, it is possible to modify the driver to scan for any character that gives off enough light to trigger the photo-Darlington.

We've narrowed the scan down to 10 or 20 locations. Which one is pointed to by the light pen? In a typical application, the routine scans the screen and finds 10 inverse blocks. The pen is pointing to one of the blocks, but 9 of the 10 blocks are "wrong." The most efficient way to find the correct block would be to first detect the wrong blocks.

I used the process of elimination to identify the correct block. As long as the light pen points at an inverse square, it transmits +1 volt to the pushbutton input (PB0). To test a block, the routine replaces the inverse space with a regular, dark space, and it checks the voltage at the PB0. If the PB0 still holds +1 volt, the pen is not pointing at the darkened test block.

The "block off" test alone is not sufficient to positively identify the correct block. For instance, suppose the pen is pointing at the ground when the driver is called. In this case, since the pen detects no light, it does not transmit voltage to the PB0. However, when the driver tests the first block, it assumes that the light pen is pointing at the darkened test block. The solution is to add a second test: turn the test block back on by storing an inverse space there again, and check the PB0 to see if the light pen again transmits +1 volt.

These two tests usually locate the correct block, but they're not foolproof. To increase accuracy, I added another block off test. With adequate brightness and the sensitivity level set correctly, the reliability of these three tests approaches 100%.

When it does find the correct block, the driver replaces the space with an inverse

TABLE 1: Parts List for the Apple II, II Plus and IIe DIP Connector

Item	Quantity	Source	Cost
Photo-Darlington	1	Industrial electronics supplier Sylvania #ECG 3036 or RCA #MRD 360	\$4.75
1 kilohm potentiometer	1	Radio Shack (#271-227)	\$0.59
1 ohm resistor	1	Industrial electronics supplier (Radio Shack does not stock)	\$0.90
16-pin DIP connector	1	Radio Shack (#276-1980)	\$1.69
Shielded cable	3 ft.	Radio Shack (#278-1277)	\$2.39
Disposable pen (BIC Biro works well)	1		

TABLE 2: Parts List for the Apple IIc and IIe DB-9 Game Ports

Item	Quantity	Source	Cost
Photo-Darlington	1	Industrial electronics supplier Sylvania #ECG 3036 or RCA #MRD 360	\$4.75
1 kilohm potentiometer	1	Radio Shack (#271-227)	\$0.59
1 ohm resistor	1	Industrial electronics supplier (Radio Shack does not stock)	\$0.90
Male DB-9 connector	1	Radio Shack (#276-1537)	\$1.99
Shielded cable	3 ft.	Radio Shack (#278-1277)	\$2.39
Disposable pen (BIC Biro works well)	1		

block (the last test is a block off test) and sounds a two-pitch bell different from the Apple's bell. The horizontal and vertical counters already indicate the correct coordinates, so the driver returns to the calling program with an RTS.

If the driver does not find the correct block during the first scan down the screen, it returns to the top and scans again. The routine will return to the calling program only if it can find the correct block.

INSTALLING THE SYSTEM

To incorporate the Nibble Light Pen system into your own program, first place an

inverse block or blocks on the screen. In BASIC, the code might look like this:

```
10 VTAB 10: HTAB 12: INVERSE:
PRINT " ": NORMAL
```

Next, CALL 770 (hex \$302) which is the driver, and touch the light pen to any inverse block on the screen. When the software has found the spot you're pointing at (it only takes a fraction of a second), you will hear a beep. Locations 768 and 769 now contain the vertical and horizontal coordinates of the inverse block you indicated.

It is important to note that the horizontal and vertical counters start counting at zero.

Nibble Light Pen, ProDOS Directory List, ProCursor, DISPLAY and programs from Nibbling at Assembly Language V are available on diskette for an introductory price of \$17.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 3/31/86.

LISTING 1: PEN.DRIVER

```
1 *****
2 " PEN DRIVER
3 " BY DAVID GAUGER II "
4 " COPYRIGHT (C) 1986
5 " BY MICROSPARC, INC "
6 " CONCORD, MA 01742 "
7 *****
8 "
9 " MERLIN ASSEMBLER
10
```

```

11
12 • THIS PROGRAM EXPECTS A PHOTO-DARLINGTON TO BE CONNECTED
13 • FROM PIN 1 TO PIN 2 OF THE GAME PORT.
14 • INPUT IS READ FROM PB0 (PIN 2): ADDRESS $C061 (-16287)
15 • ADDITIONALLY, A 1 OHM RESISTOR IS NEEDED FROM PIN 2
16 • TO PIN 6 OF THE GAME PORT.
17
18
19 ORG $302
20 PEN EQU $C061
21 VCOUNT EQU $300
22 HCOUNT EQU $301
23 BASCALC EQU $FBC1
24 BASL EQU $28
25 WAIT EQU $FCA8
26 SPEAKER EQU $C030
27 BELL EQU $FBDD
28
0302: A0 00 29 SETUP LDY #$00
0304: 8C 00 03 30 STY VCOUNT
0307: A9 00 31 LDA #$00
0309: 20 C1 FB 32 JSR BASCALC ;CALC ADDRESS OF FIRST LINE
33
34
030C: B1 28 35 MAINLOOP LDA (BASL),Y ;GET CHARACTER
030E: C9 20 36 CMP #$20 ;IS IT A BLOCK?
0310: F0 07 37 BEQ PENTEST ;YES -- TEST PEN
0312: C8 38 NEXTSPOT INY ;NO
0313: C0 28 39 CPY #$28 ;END OF LINE?
0315: F0 2F 40 BEQ NEWLINE ;YES
0317: 4C 0C 03 41 JMP MAINLOOP ;NO - DO IT ALL AGAIN
42
43
031A: A9 A0 44 PENTEST LDA #$A0
031C: 91 28 45 TEST1 STA (BASL),Y ;TURN OFF BLOCK
031E: 20 58 03 46 JSR DETECT ;ANY LIGHT?
0321: F0 07 47 BCC TEST2 ;NO - TEST PASSES
0323: A9 20 48 LDA #$20 ;YES - TEST FAILS
0325: 91 28 49 STA (BASL),Y ;WHERE YOU GOT IT
0327: 4C 12 03 50 JMP NEXTSPOT ;AND TRY NEXT SPOT
032A: A9 20 51 TEST2 LDA #$20
032C: 91 28 52 STA (BASL),Y ;PUT BLOCK BACK
032E: 20 58 03 53 JSR DETECT ;ANY LIGHT?
0331: B0 03 54 BCS TEST3 ;YES - TEST PASSES
0333: 4C 12 03 55 JMP NEXTSPOT ;NO - TRY NEXT SPOT
0336: A9 A0 56 TEST3 LDA #$A0
0338: 91 28 57 STA (BASL),Y ;TURN BLOCK BACK OFF
033A: 20 58 03 58 JSR DETECT ;ANY LIGHT?
033D: 90 43 59 BCC EXIT ;NO - TEST PASSES - BLOCK FOUND
033F: A9 20 60 LDA #$20
0341: 91 28 61 STA (BASL),Y ;SO PUT BLOCK BACK
0343: 4C 12 03 62 JMP NEXTSPOT ;AND TRY AGAIN
63
0346: EE 00 03 64 NEWLINE INC VCOUNT ;INCREMENT VERT COUNTER
0349: AD 00 03 65 LDA VCOUNT
034C: C9 18 66 CMP #$18 ;IS IT MORE THAN THE 24TH LINE?
034E: F0 B2 67 BEQ SETUP ;YES - TIME TO START AT THE TOP
0350: 20 C1 FB 68 JSR BASCALC ;NO - FIGURE NEW BASE ADDRESS
0353: A0 00 69 LDY #$00 ;ZERO HORIZONTAL COUNTER
0355: 4C 0C 03 70 JMP MAINLOOP ;AND DO IT ALL AGAIN
71
0358: 8C 01 03 72 DETECT STY HCOUNT ;SAVE HORIZONTAL COUNTER
035B: A2 08 73 LDX #$08 ;SET UP COUNTER
035D: A0 00 74 LDY #$00 ;LOAD Y COUNTER
035F: AD 61 C0 75 GETPEN LDA PEN ;SEE IF PEN SAW LIGHT
0362: 30 0B 76 BMI YESLITE
0364: 88 77 DEY
0365: D0 F8 78 BNE GETPEN ;THIS LOOP TESTS THE PEN
0367: CA 79 DEX ;MANY TIMES
0368: D0 F5 80 BNE GETPEN
036A: 18 81 CLC ;CLEAR CARRY: NO LIGHT
036B: AC 01 03 82 LDY HCOUNT ;RESTORE HORIZONTAL COUNTER
036E: 60 83 RTS
036F: 38 84 YESLITE SEC ;SET CARRY: YES LIGHT
0370: AC 01 03 85 LDY HCOUNT ;RESTORE HORIZONTAL COUNTER
0373: 60 86 RTS
87
0374: A0 C0 88 BELL2 LDY #$C0 ;LENGTH OF BELL2
0376: A9 08 89 LOOP LDX #$08 ;PITCH OF BELL2
0378: 20 A8 FC 90 JSR WAIT
037B: AD 30 C0 91 LDA SPEAKER ;CLICK SPEAKER
037E: 88 92 DEY ;DECREMENT COUNTER
037F: D0 F5 93 BNE LOOP ;DO IT ALL AGAIN
0381: 60 94 RTS
95
0382: 18 96 EXIT CLC ;FOR SAFETY
0383: A9 20 97 LDA #$20
0385: 91 28 98 STA (BASL),Y ;WHERE YOU GOT IT
0387: 20 DD FB 99 JSR BELL ;REGULAR BELL
038A: 20 74 03 100 JSR BELL2 ;DIFFERENT BELL FOR FUN
038D: 60 101 RTS

```

--End assembly--

140 bytes

Errors: 0

END OF LISTING 1

continued on page 136

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The vertical counter ranges from 0-23, and the horizontal, from 0-39. If the driver returns with a vertical value of 16 and a horizontal value of 20, this is the same spot on the screen as one defined by VTAB 17 and HTAB 21.

The pen's resolution is partly determined by the photo-detector. I have used photo-Darlingtons that can resolve one block of light in two. This means that an inverse block cannot be placed immediately adjacent on any side. The photo-Darlington can adequately resolve light blocks immediately diagonal to one another fairly well. Should you want to place a block on every line or column, the blocks must be placed diagonally in zigzag fashion in order for the pen to discern them.

APPLICATIONS

Your imagination is the only limit to your applications of the Nibble Light Pen. For example, a typical instruction screen might have the prompt at the bottom: "Press <RETURN> to continue." Instead of using an INPUT or GET statement to control program flow at this point, place one inverse space on the screen labeled "Touch pen here to continue." Then call the light pen driver. The driver will not return to the calling program until it finds the block at which the pen is pointing. The result is effective program control without using the keyboard.

Another obvious use is in menu selection. In any computer magazine you'll find plenty of advice on menu input, how to organize menu screens, and the error trapping that inevitably accompanies keyboard input. Using a light pen with a menu eliminates many of these problems.

I have written a simple demonstration program to illustrate these two applications. Simply type in Listing 2, and save it on a disk that already contains the light pen driver (PEN.DRIVER, Listing 1) with the command:

SAVE LIGHT.PEN.DEMO

This demonstration program uses the light pen in the most simple and elementary ways; it's just meant to get you started. Other applications could include graphics, data input, screen layout and games. It may also be an ideal input device for people with certain handicaps, and it is flexible enough to be incorporated into just about any program or language.

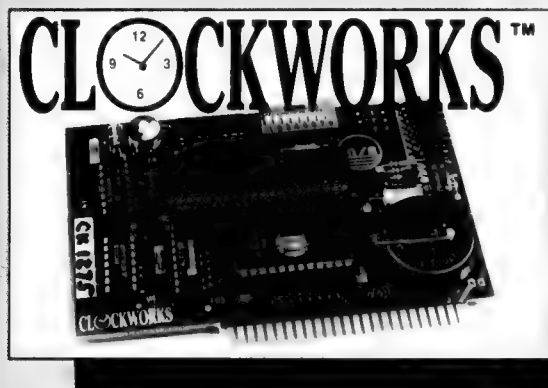
MODIFICATIONS

Here are a few ideas for changes you can make. The routine can be changed to scan the screen for characters other than the inverse block. It could also be adapted to scan for a range of characters, such as the entire inverse character set or just inverse numbers. I have found the system sensitive enough to detect regular video characters,

although the period and comma present some difficulty.

You may find that from time to time the driver makes a mistake and returns with the coordinates of a block to which you are not pointing. In writing the driver I sacrificed a bit of accuracy in favor of speed. The portion of code that actually detects light from the pen, the DETECT subroutine, is the culprit. Specifically, lines 74 and 75 are counters that form loops to check the pen for light 2,048 times, each time the subroutine is called. Obviously, this takes a bit of time even at machine language speed, but the more times you check the pen for light, the more accurate your results will be. If you require more accuracy and are willing to forego execution speed, I suggest that you LDX with 0A in line 74. If you're assembling the driver at hex \$302, this means that you store 0A at location hex \$35C.

Resolution could perhaps be improved by changing the photo-Darlington, arranging a tube to narrow the area of light it responds to, or substituting another photo-detector such as a photo-diode or light-dependent resistor. Another idea is to use the low resolution graphics mode to scan for the pen. Theoretically, this should double the pen's resolution. Also, there is no reason why another pushbutton input could not be used. Using PB2 would allow you to use the paddles or a joystick simultaneously with the light pen (this is not feasible on the //c).



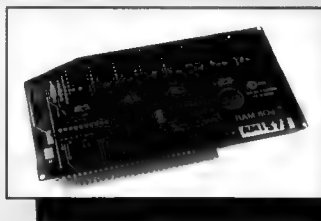
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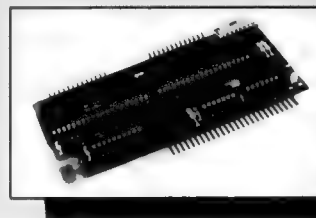


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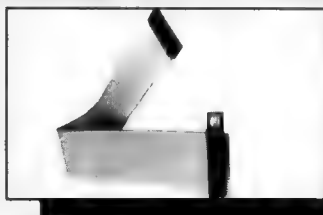
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CIRCLE NUMBER 69



LISTING 2: LIGHT.PEN.DEMO

```

1 REM *****
2 REM * LIGHT PEN DEMO *
3 REM * BY DAVID GAUGER II *
4 REM * COPYRIGHT (C) 1986 *
5 REM * BY MICROSPARC, INC *
6 REM * CONCORD, MA 01742 *
7 REM *****
100 REM *** INITIALIZE ***
110 GOSUB 190
120 PRINT CHR$(4); "BLOAD PEN.DRIVER"
130 PEN = 770: REM LOCATION OF MACHINE LANGUAGE DRIVER
140 V = 768: H = 769: REM VERTICAL (COLUMN) AND HORIZONTAL (ROW) COORDINATE LOCATIONS
150 GOTO 210
160 REM *** SUBROUTINES ***
170 INVERSE: PRINT " ": NORMAL: RETURN: REM SUBROUTINE TO PRINT AN INVERSE SPACE (BLOCK) ON THE SCREEN
180 PRINT " ": RETURN: REM SUBROUTINE TO PRINT A SPACE
190 TEXT: HOME: RETURN
200 REM *** MAIN PROGRAM ***
210 HOME: HTAB 5: PRINT "NIBBLE LIGHT PEN DEMONSTRATION": PRINT "** COPYRIGHT 1986 BY MICROSPARC, INC. **"
220 VTAB 8
230 PRINT "THIS PROGRAM IS MEANT TO DEMONSTRATE"
240 PRINT "ONE POSSIBLE USE FOR THE NIBBLE LIGHT"
250 PRINT "PEN IN YOUR OWN PROGRAMS."
260 PRINT: PRINT
270 PRINT
280 PRINT "PLEASE NOTE THAT THE PROGRAM IS NOW"
290 PRINT "WAITING FOR YOU TO TOUCH THE INVERSE"
300 PRINT "SPACE WITH THE LIGHT PEN."
310 VTAB 23: HTAB 5
320 PRINT "TOUCH PEN HERE TO CONTINUE ==>";
330 GOSUB 170: REM PRINT INVERSE SPACE
340 CALL PEN: REM PROGRAM CONTROL PASSED TO LIGHT PEN DRIVER WHICH RETURNS ONLY WHEN IT FINDS PEN
350 REM *** MENU SCREEN ***
360 GOSUB 190: HTAB 5: PRINT "NIBBLE LIGHT PEN DEMONSTRATION"
370 VTAB 8: HTAB 12: GOSUB 170: GOSUB 180
380 PRINT "CATALOG DISK"
390 VTAB 11: HTAB 12: GOSUB 170: GOSUB 180
400 PRINT "RING BELL"
410 VTAB 14: HTAB 12: GOSUB 170: GOSUB 180
420 PRINT "LIST PROGRAM"
430 VTAB 17: HTAB 12: GOSUB 170: GOSUB 180
440 PRINT "END"
450 CALL PEN
460 REM * LIGHT PEN DECODING *
470 IF PEEK(V) = 7 THEN PRINT CHR$(4); "CATALOG": FOR X = 1 TO 2000: NEXT X: GOTO 360
480 REM NOTE THAT THE DRIVER RETURNS (V) ONE LESS THAN THE VTAB VALUE OF THE SAME SPOT
490 REM NOTE ALSO THAT WE DON'T HAVE TO DECODE THE HORIZ. VALUE IN THIS CASE BECAUSE THE VERTICAL VALUE ALONE IS ENOUGH
500 IF PEEK(V) = 10 THEN PRINT CHR$(7) + CHR$(7) + CHR$(7) + CHR$(7) + CHR$(7); GOTO 360: REM 5 BELLS
510 IF PEEK(V) = 13 THEN HOME: LIST: HOME: GOTO 360
520 REM IF (V)=16 THEN THE PROGRAM WILL FALL THROUGH TO THIS POINT
530 END

```

END OF LISTING 2

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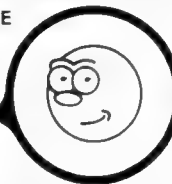
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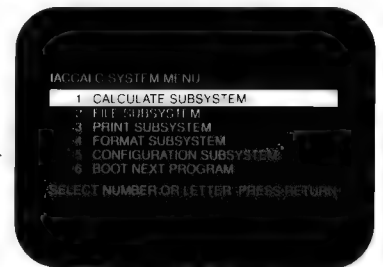
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IACcalc System Menu defines subsystems.



Q.A.

by Cecil Fretwell

ASK NIBBLE!

Q. Under ProDOS, I like for my STARTUP file to show the volume name. Therefore, my STARTUP programs usually include a line like `10 PRINT "/MY.DISK/"`. Recently, I typed `10 /MY.DISK/` instead. When I booted the system, it "went South" (it died). What's wrong with ProDOS?

A. All software developers try to write perfect programs, but they suffer occasional lapses. Such is the case with the ProDOS developers at Apple Computer. In a running Applesoft program, the BASIC.SYSTEM file loaded in a normal boot situation has a problem. It always traps the first byte in an Applesoft program line by making the Applesoft ROM firmware think TRACE mode is in effect. Unfortunately, the system code assumes the first byte in a line is a variable or a token.

In your case, the system went into an infinite loop trying to process the first byte in the line (the slash character). If you are really curious, try various combinations on a disk you can afford to lose. For instance, `10 OR` as the first line will make the system go dead with the "in use" light active on the drive.

Fixing this bug would require a change in BASIC.SYSTEM that would only be valid for one particular version. Apple will probably fix it in a later release. But in the meantime, just be very careful when you key in an Applesoft program.

Q. Recently, I switched from DOS 3.3 to ProDOS. Having some knowledge of assembly language programming, my normal assembly code for `PRINT CHR$(4); "string"` sends \$84 through COUT (\$FDED) followed by the string. It doesn't work under ProDOS.

A. Obviously, ProDOS handles this situation differently from DOS 3.3. Under ProDOS, don't send the `CHR$(4)` processing through COUT. Instead, place the string in the \$200 keyboard buffer terminated by a carriage return (\$D). Then perform `JSR DOSCMD ($BE03)`. If the carry flag is returned clear, your "command" was executed successfully. If the carry flag is set, you have an error and the Accumulator contains the error code, such as \$10 for a SYNTAX ERROR.

This does not solve all your problems, though. Apple Computer sends technical notes to authorized developers when they release a new system. Their Technical Note 2 shows that CATALOG, CAT, PREFIX, CREATE, RENAME, DELETE, LOCK, UNLOCK, VERIFY, SAVE, STORE, RESTORE, PR#, IN#, FRE,

BYE, OPEN, CLOSE, FLUSH, POSITION, BRUN, BLOAD and BSAVE work correctly from machine language and return control to the calling routine. On the other hand, the hyphen (-), RUN, LOAD, CHAIN, READ, WRITE, APPEND and EXEC do not work correctly and/or do not return control to the calling routine. In most of these cases, there is no easy fix without modifying BASIC.SYSTEM.

Q. Under assembly language control, I want to LOAD a program, then RUN it. Placing RUN followed by a carriage return (\$8D) in the keyboard buffer at \$200, then using `DOSCMD ($BE03)` produces some strange effects. Is there a solution?

A. As explained in the answer to the previous question, RUN is one of the commands that doesn't work correctly. However, after limited testing, I would say there is a solution. You are on the right track but need some additional code. Issuing a RUN through `DOSCMD` places you in the running state. However, at the end of `DOSCMD` the carry flag is set and the Accumulator contains the Applesoft SYNTAX ERROR code (\$10).

Don't worry about the error code. After you use `DOSCMD` to execute the RUN, perform a `JSR $D664`. This initializes an Applesoft program with regard to variable pointers, and then performs a `JMP $D7D2` to start a new program.

Q. Under DOS 3.3, when an Applesoft program requires a large chunk of memory for an assembly language subroutine, I can lower HIMEM by using the HIMEM statement in the program or storing the desired value in \$73 and \$74. I recently CONVERTed to ProDOS a program that had its HIMEM at location 38208 (\$9540). When I executed the program, it bombed. Why does the program work under DOS 3.3 but not ProDOS?

A. You are violating a very important ProDOS rule. The system always assumes that HIMEM points to a page boundary, i.e., that \$73 is always zero. Change HIMEM :38208 to `HIMEM:38144 ($9500)` to set things right.

By the way, I don't like to move HIMEM in this fashion because it assumes that the string storage area in memory is empty. If I want to tuck some code between string storage and the system code, I first load the code into a safe location in memory such as \$2000 and execute it. I load the Accumulator with the number of memory pages required, then issue a `JSR GETBUFR ($BEF5)`. (Apple documents this procedure in technical notes it releases to authorized developers). If the carry bit returns set, the system could not allocate the amount of memory requested. If the carry bit returns clear, string storage has been safely shifted down in memory and the Accumulator contains the beginning page of the allocated memory. I use this value to move the desired code from the \$2000 area to the allocated memory.

Apple expert Cecil Fretwell answers your tough questions on topics ranging from ProDOS and printing to the internals of the Apple. Send your questions to: Ask Nibble, 45 Winthrop St., Concord, MA 01742. We can't promise to answer all of them, but we're sure that you'll find a wealth of new information in the ones we publish!





The Apple

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CIRCLE NUMBER 123



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CIRCLE NUMBER 124

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CIRCLE NUMBER 125

SERIAL GRAPPLER+ is a printer interface card featuring built-in screen print commands to allow Hi-Res or double Hi-Res graphics or text to be printed with a few keystrokes. It allows you to print graphics in inverse, rotated, enlarged or in emphasized mode. **SERIAL GRAPPLER+** is compatible with Imagewriters I and II, and the Scribe. The price is \$119. An optional buffer, Bufferpack, is available with 16K, 32K or 64K. Contact: Orange Micro, 1400 N. Lakeview Ave., Anaheim, CA 92807, (714) 779-2772.

CIRCLE NUMBER 126

TAXPAK-86 is a menu-driven program for preparation of the 1985 form 1040 and Schedules A, B, C, D, G, SE and W. As each entry is made, all affected lines are updated and information is transferred from form to form. It always displays your current tax liability as well as the impact of the most recently entered transaction, so you can explore alternative tax strategies. It runs on Apple // series computers with 64K. The price is \$39.95. Contact: AHWARE, 805 Luz Court, Danville, CA 94526, (415) 837-7346.

CIRCLE NUMBER 127

P.A.C.K. (Programmer's Assembly-Language Construction Kit) explains how to create, use and update subroutine libraries. It provides relocatable subroutines plus Editor, Assembler and Linking Loader utilities that you can combine into your own programs. **P.A.C.K.** is written in machine language for the Apple // series. Its price is \$49.95 plus \$3.00 shipping; specify DOS 3.3 or ProDOS. Contact: Interactive Arts, 2715 Porter St., Soquel, CA 95073, (408) 475-7047.

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FANTAVISION is a special effects and animation generator for Apple // series computers with 64K. It uses techniques called "tweening" — creating smooth motion by generating 64 intermediate positions between objects, and "transformation" —

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CIRCLE NUMBER 129

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CIRCLE NUMBER 130

BATTLE OF ANTIETAM, NORWAY 1985, and U.S.A.A.F. are strategy games. BATTLE OF ANTIETAM recreates the 1862 Civil War battle. NORWAY 1985 is an advanced-level game about the Soviet occupation of Norway and NATO's counter-attack. U.S.A.A.F. (United States Army Air

Force) is a simulation of daylight bombing of German industry from 1943-1945. The programs are all one- or two-player games and run on the Apple II series. Their prices are \$49.95, \$34.95 and \$59.95, respectively. Contact: Strategic Simulations, Inc., 883 Stierlin Rd., Bldg. A-200, Mountain View, CA 94043, (415) 964-1353.

CIRCLE NUMBER 131

STICKYBEAR PRINTER is a graphic design and print program that makes it easy for children to create cards, stationery, posters, full-screen and half-screen pictures, and banners. Dozens of background and border patterns, hundreds of decorations and 10 fonts are included. It runs on the Apple II series and works with the Imagewriter II and Scribe, in addition to most dot matrix printers. It is priced at \$39.95. Contact: Optimum Resource, Inc., Station Place, Norfolk, CT 06058 (203) 542-5553.

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PROFESSOR HALLEY'S COMET PURSUIT indicates the elevation and direction of Halley's comet at any time from any place on earth, making it easier for you to track it in the sky. Using both text and graphics, the program shows the correct azimuth and altitude. Background stars are plotted relative to the comet's position. The program includes a trivia game with over 500 questions on topics including solar science, comets, Edmond Halley and astronomy terminology. It runs on the Apple // series and is priced at \$39.95. Contact: Olympus Educational Software, 1660

Hotel Circle N., Suite 310, San Diego, CA 92108, (619) 296-8475.

CIRCLE NUMBER 134

NOW THAT YOU KNOW ASSEMBLY LANGUAGE: WHAT YOU CAN DO WITH IT? is a book for people with some knowledge of 6502 assembly language. It explains how to develop a library of subroutines, how to access the 6502 stack, and how to minimize your coding by using the Apple's built-in routines. It is priced at \$19.95. A disk containing the source code and one con-

taining the object code for the book's programs are \$15 each. Contact: Relig Systems, Inc., 2068 79th St., Brooklyn, NY 11214, (718) 232-8429.

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BUSINESSCARD includes two serial interfaces and a clock/calendar with battery backup. It allows you to print text, and black-and-white or color graphics. It has over 60 built-in commands for clock, modem, and printing applications. It can drive a serial printer (including the Image-writer II), and operate a 300 or 1,200 baud modem. It works with an Apple II Plus or //e. //e users are able to access commands from pull-down menus. The price is \$219.95 (includes printer cable). Contact: Street Electronics, 1140 Mark Ave., Carpinteria, CA 93013, (805) 684-4593.

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Here, you see:

An empty beer bottle with most of the label missing.

It is Monday.
You are wearing filthy rags.

What would you like to do?

GO
LOOK
TAKE
EXAMINE
INVENT
NOTHING

HELP
SAVE
RESTART
QUIT

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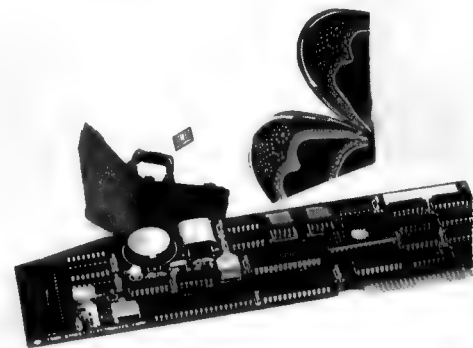
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Due to the delicate nature of some Real Life issues, this product is not recommended for children under 13.

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BusinessCard



APPLEWORKS — THE PROGRAM FOR THE REST OF US answers the most commonly-asked questions about how to use the AppleWorks program. Written by Michael Sloan, who provides technical support for Apple Computer, Inc., the book guides you through all the major commands and options for the word processing, database and spreadsheet applications. It explains how to use AppleWorks with other programs and includes dozens of screen displays and examples. Contact: Scott, Foresman and Company, 1900 E. Lake Ave., Glenview, IL 60025, (312) 729-3000.

CIRCLE NUMBER 137

PROGRAMMERS: New DAVID-DOS II™

HIGH-SPEED DOS 3.3

DOS-MOVER/FAST-GARBAGE

Makes high-speed disk access under all conditions. DOS-mover frees 10,000 bytes of extra memory for programs. FRE command does ultra-fast garbage collection. Clock or manual disk dating. May be licensed.

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Use HIDOS command in hello program for turnkey startup, adding 10K free memory to run 30% larger Applesoft programs than ProDOS. Moves DAVID-DOS II and 4 buffers above main memory.

Ultra-Fast Garbage

New FRE command collects a memory full of 6000 strings that are half garbage in two seconds. DOS 3.3 takes 12 minutes. FRE is so fast it is not noticeable during run of most programs.

Clock Dating

Automatic date stamping of disk files is set up for 6 kinds of clocks or Hello manual date entry. New DATE command will auto-insert date in correspondence.

All times in seconds. (Time Test programs available)		DAVID DOS-II	ProDOS	DOS 3.3
TEXTFILES (100 Sectors)	TSAVE	8.0	NO	NO
	TLOAD	6.2	NO	NO
(791 Strings, 32 chars ea)	WRITE	29.3	28.0	88.4
	READ	24.3	16.3	83.8
	PRINT/READ	44.2	45.9	117.1
(442 Sectors, 7 x 500)	APPEND	142.3	142.9	1231.2
APPLESOFT (100 Sectors)	*SAVE	8.4	16.4	33.1
	LOAD	5.0	4.0	23.5
INTEGER (100 Sectors)	*SAVE	6.6	NO	33.4
	LOAD	4.9	NO	23.4
BINARY (100 Sectors)	*BSAVE	7.3	16.4	28.7
	BLOAD	5.8	4.6	24.5
48K PROGRAM SPACE (With 3 Bufs avail)	APPLESOFT	36.352	NO	36.352
	INTEGER	36.352	NO	36.352
	BINARY	36.352	34.816	36.352
64K PROGRAM SPACE (With 4 Bufs avail)	APPLESOFT	46.592	32.256	35.756
	INTEGER	46.592	NO	35.756
	BINARY	46.592	41.728	35.756

*Add 5 seconds for Verify Apple II, Applesoft & ProDOS are trademarks of Apple

Ten New DOS Commands

1. HIDOS moves DOS above 48K memory.
2. FRE makes ultra-fast garbage collection.
3. DATE stamp files. Clock or manual dating.
4. TLOAD speed loads all Text Files to mem.
5. TSAVE speed saves Text Files from memory.
6. TLIST lists all Text Files to screen/printer.
7. DUMP Binary/Ascii to screen or printer.
8. DISA disassembles Binary to screen/printer.
9. AL prints program Address & Length.
10. / is a one keystroke Catalog.

DAVID DATA

CIRCLE NUMBER 72

Identical Operation

All new commands operate identical to old DOS commands on the keyboard & in programs.

Install in Three Seconds

Install DAVID-DOS II on your full disks in three seconds without touching the programs. Create bootable high-speed new disks with a Basic, Binary, or Exec Hello & 35/40 tracks. Create Data-Disks with 30 extra sectors.

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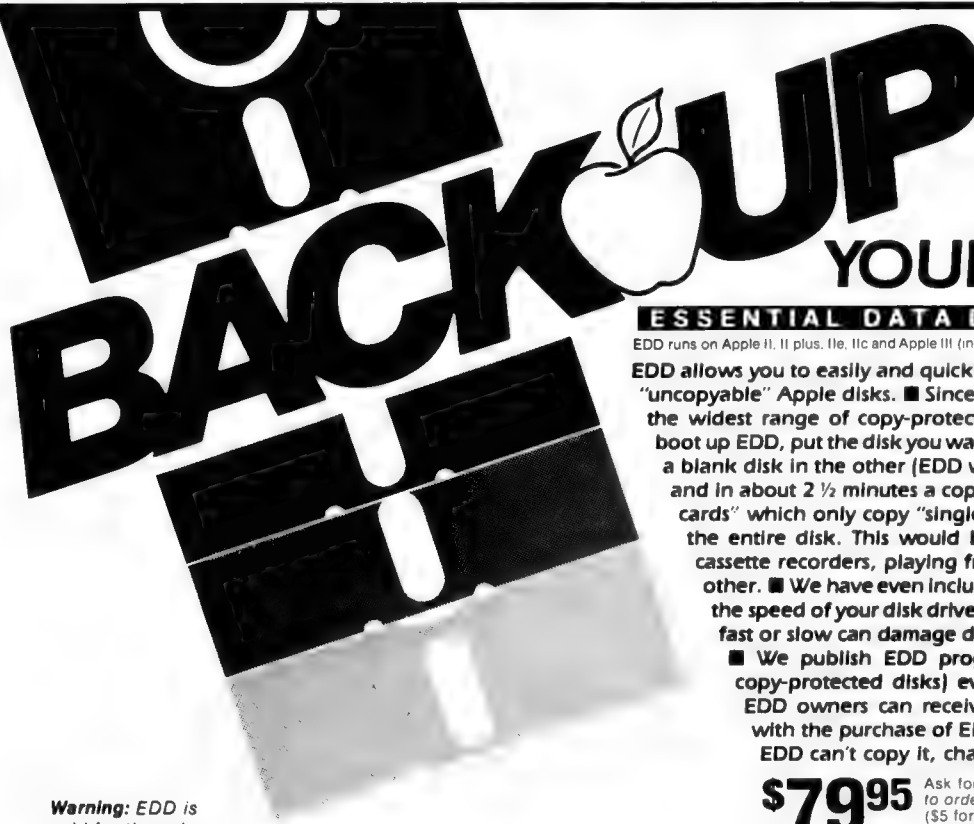
Key operated variable speed scrolling for TLIST, DUMP and DISA. Lower-case accepted on all commands. Catalog shows Free-Space. Automatic support of Integer or Applesoft Card in any slot, while in HIDOS or LODOS. Vendor license includes protection system.

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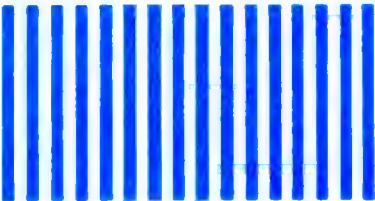
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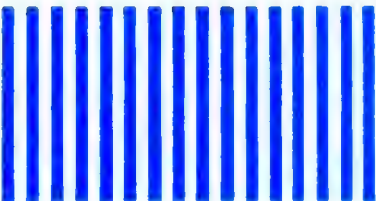
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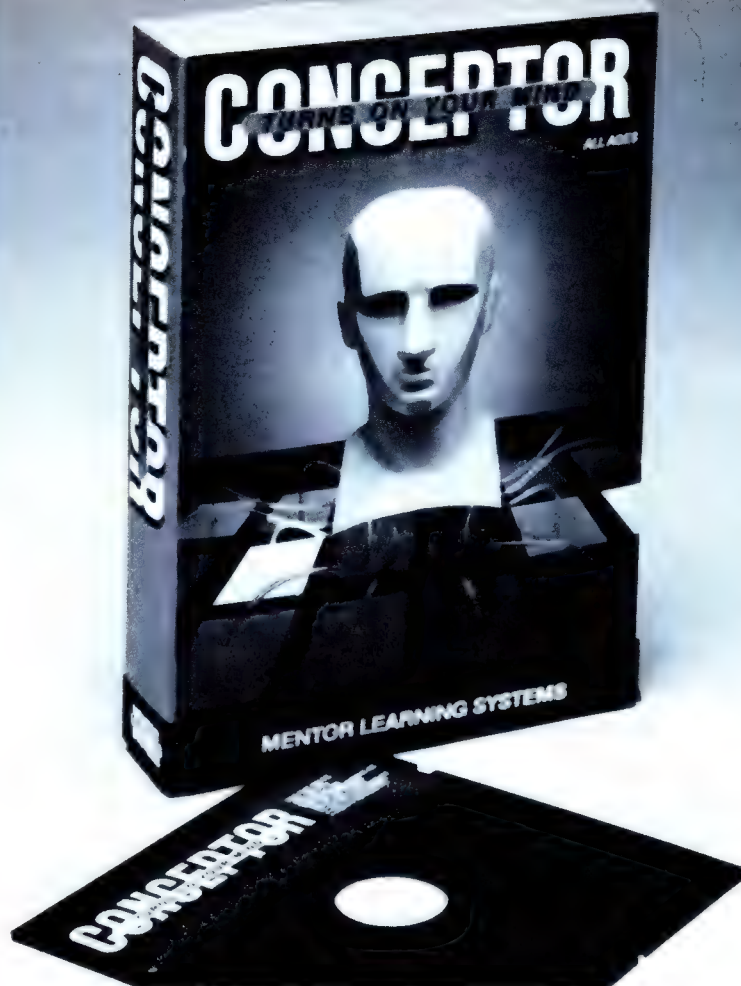


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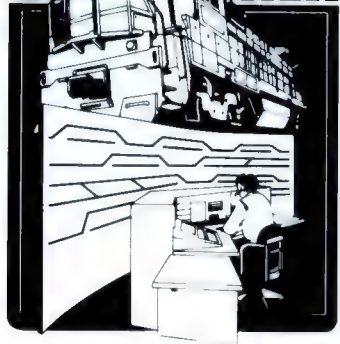
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6. Enter the path name (prefix/filename) for each file to be converted. Do this one file at a time. Any file name that contained a space under DOS 3.3 has been changed; all spaces are converted to periods under ProDOS. The file should then load into memory as an Appleworks WP file.

7. Save the file to disk using a *new* file name.

Now, if you made no mistakes, you have converted a text file for AppleWorks word processing. You will have to change any embedded control characters for the printer, and you will need to reformat the document. Otherwise, you're all set.

One final note: Unfortunately, Apple Computer does not provide access to AppleWorks for early models of the Apple II. You must own an Apple IIc or Apple IIe with an extended 80-column card to take advantage of AppleWorks' features. However, an independent software developer, Norwich Data Services, Ltd., now provides a reconfiguration of AppleWorks for Apple II Plus owners (called Plus-Works), making it possible to run AppleWorks on a 64K, 80-column Apple II Plus.

Larry Solomon
Tucson, AZ

Higher FID

I enjoyed Donald Miller's article on mov-

ing FID to the RAM card ("Vigilant FID," Vol. 6/No. 6). However, I don't like running a loader program to install it. Changing the following lines in FID.CONVERTER will result in a version of FID.RC that can be BRUN and will install itself on the RAM card.

Line 30 prints a count on the screen (I didn't like the way the program appeared to hang as it did its stuff). Line 220 calls the new subroutine and then saves FID.RC to disk. Line 550 is a subroutine that POKES the machine code into memory just before the image of FID. Lines 560-610 are the data for the machine code.

```
30 M = M + 1: VTAB 14: HTAB
18: PRINT M:F = 0: IF
M > 8983 THEN 140
220 GOSUB 550: PRINT CHR$
(4) "BSAVE FID.RC, A$17
6A, L4854"
550 FOR I = 5994 TO 6146:
READ N: POKE I, N: NEXT
: RETURN : REM POKE I
N RELOCATOR
560 DATA 141,129,192,141
,129,192,169,0,133,60
,133,66,168,169,255,1
33,62,133,63,169,248,
133,67,133,61,32,44,2
54,160,18
570 DATA 185,210,23,153,1
57,165,136,208,247,16
9,70,141,241,168,169,
73,141,242,168,169,19
6,141,243,168,169,64,
141,239,168,160
```

```
580 DATA 0,185,3,24,153,3
,208,200,208,247,238,
169,23,238,172,23,173
,172,23,201,227,208,2
34,32,47,251,32,88,25
2,160
590 DATA 0,185,229,23,240
,6,153,0,4,200,208,24
5,76,208,3,32,57,251,
173,131,192,173,131,1
92,32,3,208,173,129,1
92
600 DATA 76,211,3,213,211
,197,160,167,198,201,
196,167,160,198,210,2
07,205,160,208,210,20
7,205,208,212,160,212
,207,160,210,213
610 DATA 206,174,0
```

Kevin Sartorelli
New Zealand

Cleaner Heads

I have very much enjoyed your magazine ever since I started reading it about two years ago. Since then I have heard of people having trouble cleaning the disk drive heads on drive two. I have the solution. These POKEs turn on the drives (in slot 6), but they don't read or write on the disks:

POKE 49385,0	Turns drive on
POKE 49384,0	Turns drive off
POKE 49386,0	Selects D1
POKE 49387,0	Selects D2

James Faircloth
New Orleans, LA

echo plus copy program

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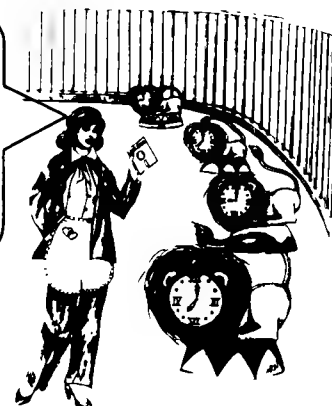
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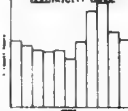
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SHOPPING LIST performs filing, editing, and display of your personal shopping items. (V3 #6)

PRINT USR formats big and little numbers in your Applesoft programs with automatic decimal alignment and more. (V3 #6)

COMPARE APPLESOFT is a valuable utility for comparing different versions of your programs for changes, additions, and deletions. (NE 3)

Order Reference: [BC]...\$22.95 + shipping

AMP-L-SOFT is a whole library of utilities under ampersand control. Gives you machine language control of tones, bits, tag sort, substring search, and hex conversion. Adds machine language speed to your Applesoft programs. (NE 3)

ELECTRONIC MESSAGE CENTER is a message handler for displaying sequences of messages for home and business. (NE 3)

APPLE BOWL FOOTBALL is a fast moving text game that uses actual football statistics to produce a realistic simulation of the game. (NE 3)

Order Reference: [AP]...\$29.95 + shipping

THE SHAPE is a powerful free form shape table creation program. Create your shapes in Lo-Res graphics and translate them into Hi-Res shape tables automatically. (NE 3)

LIGHTSABER BATTLE pits Darth and Luke in a slugfest in Lo-Res graphics. (V3 #7)

PRICE DEMO uses a product pricing problem to illustrate disk file indexing. (V3 #7)

APPLE SCROLLER puts right, left, and downward text scrolling at your fingertips in machine language. (V3 #7)

LOWER CASE WRITER lets you type upper and lower case characters to your Hi-Res screen. (V3 #7)

Order Reference: [SH]...\$23.95 + shipping

APPLE RECIPE BOX makes cook-bookings simple! Retrieve, edit, and display, and print your favorite recipes with automatic portioning of different servings. (NE 3)

APPLE DISK DOCTOR is a comprehensive "zap" utility for direct reading, writing, and editing of your disks. See how DOS stores your data! (NE 3)

QUASAR II puts you in command of a starship charged with clearing distant galaxies, meteors, and asteroids. A Nibble version of the popular "Asteroids" game. (NE 3)

Order Reference: [RB]...\$29.95 + shipping

FAT GRAPH gives you Hi-Res graphics tracking of your dieting objectives and weight lost. (V3 #8)

SOUTHERN DRAW is a new precision "pencil" cursor for Hi-Res graphics. (V3 #8)

SAV-DEL lets you save-delete selected Applesoft arrays without having to clear all of memory. (V3 #8)

FINANCIER/TAX DEPRECIATION adds new tax rules and updates for the economic recovery act. (V3 #8)

Order Reference: [FT]...\$23.95 + shipping

APPLE DISK LIBRARIAN lets you get control of those big DOS 3.3 disk libraries. Handles up to 500 disks with sorting, editing, and search. (NE 4)

FAST GO-TO PROCESSOR is a machine language shortcut to Applesoft subroutines! Up to 100% speed improvement with GOTO and GOSUB commands. (NE 4)

'PILLAR MUNCH is a fast action arcade game. Watch your 'pillar grow! Munch enough, and your 'pillar turns into a butterfly. (NE 4)

Order Reference: [LB]...\$29.95 + shipping

APPLE IRS is a tax estimating program for evaluating alternative income, investment and tax strategies. (V4 #1)

TINY TYPER is a short, powerful text editor with append, erase, compact, format, and editing of text files. (V4 #1)

COMPACT SORT does fast machine language sorting of Applesoft arrays in ascending/descending sequences. (NE 4)

LINE EDIT uses ROM techniques for full width Applesoft screen listings. (V4 #1)

Order Reference: [IR]...\$23.95 + shipping

THE NIBBLE INVESTOR is a comprehensive tracking, analysis, reporting and graphics charting system for your stocks and investments. A best-seller with five different reports. (NE 4)

DISK MAP SYSTEM is a disk analysis program that prints and analyzes your DOS 3.3 disk files, their location and use of disk space. (V4 #2)

SPACE ROVER is an arcade game demonstrating the use of graphics scrolling of landscapes. (V4 #2)

Order Reference: [IV]...\$29.95 + shipping

CHAMP-R is an indexed reporting system for checks and accounts developed with the CHAMP, Checkbook Management System. (V4 #2)

FORMULA I is a Hi-Res racing game with five different track patterns, barriers and speeds. (NE 4)

FILE NAME MOVER is a DOS 3.3 disk utility that lets you switch/exchange catalog names to put them in the proper sequence. (V4 #2)

Order Reference: [FO]...\$23.95 + shipping

THE NIBBLE DESIGNER AND ILLUSTRATOR are companion programs for creating, editing, and displaying complex graphics screens. They let you scale, edit, rotate, and even redraw your shapes in medium resolution graphics and then retrieve and control them in building your own design. (NE 4)

DISK ZAP lets you read, examine, edit, and write your disk sectors directly. Great for exploring disk storing techniques and repairing damaged sectors. (NE 4)

NIBBLE INFERNO is a Hi-Res arcade game in which you rescue children from a burning orphanage. (V4 #3)

Order Reference: [DS]...\$29.95 + shipping

POINTERS is a set of Applesoft utilities to recover from resets, FP commands, and split and overlay programs. (V4 #3)

SORT FIVE is a case study in five different Applesoft sorting techniques. (V4 #3)

SELF-MODIFYING APPLESOFT lets you change Applesoft programs while they're running without losing variables. (V4 #3)

INTERVAL TIMER lets you time up to 25 events with control signals in machine language. (NE 4)

HIDE/UNHIDE lets you store and retrieve your DOS 3.3 programs into a RAM memory expansion card. (V4 #3)

Order Reference: [PT]...\$24.95

NIBBLE RAM MANAGER is a powerful DOS 3.3 utility that puts up to ten programs into a 16K RAM card for instant access at the touch of a key. (NE 4)

EXPENSE CALC is an easy-to-use spreadsheet program for weekly expense reporting with full scrolling and calculations. (NE 4)

SEARCH AND REPLACE automatically scans and globally or selectively replaces strings and variables in your Applesoft programs. (NE 3)

Order Reference: [RA]...\$29.95 + shipping

FLY AWAY lets you use a puffer gun to puff feathers, balloons, and other objects before they touch the ground. Arcade action! (NE 4)

AUTOSCREEN lets you create a "magic cursor" bar in your Applesoft programs for menu item selection under arrow key control. (V4 #4)

BADMINTON is a Hi-Res graphics simulation of tournament badminton. (V4 #4)

PRETTY LISTER formats your Applesoft listings to indent multi-statement lines for that "structured programming look." (V4 #4)

Order Reference: [FL]...\$23.95 + shipping

THE NIBBLE ORACLE helps analyze decision alternatives based on your priorities and weighted values for each choice. A great executive decision tool. (NE 4)

AMPER FREE SPLITTER lets you wrap Applesoft programs around protected memory areas. (NE 4)

DOTS-ELLO is a Hi-Res graphics "connect-the-dots" game. (V4 #5)

Order Reference: [OR]...\$29.95 + shipping

RAM PAD is an electronic notepad that saves up to four pages of text in a 16K RAM card. (V4 #5)

SPELLING TUTOR lets you specify your spelling list and then reinforces learning by taking letters away from each word until you type it from memory. (V4 #5)

TIME TEACHER uses a Hi-Res clock to move the big and little hand to match the time target. (V4 #5)

MATH MONSTER combines Hi-Res graphics with multiplication/division problem solving. Try to solve the problem before the Math Monster gobbles you up. (NE 4)

NEWSAVER DOS recovers Applesoft programs lost from accidental FP's and NEW's. (V4 #5)

Order Reference: [RP]...\$23.95 + shipping

THE NIBBLE PROGRAMMER lets you write structured Applesoft programs without line numbers and adds the powerful new commands LOOP and WHILE. Now you can name your subroutines with terms like GOSUB TOTALS for easy recall and self documentation. The PROGRAMMER then writes your program for you! (NE 4)

MAGAZINE ARTICLE TRACKING SYSTEM indexes, sorts, and finds key articles in your library. (NE 4)

THE NIBBLER is one of the best arcade games we've ever published. Nibble's version of PAC-MAN. (NE 4)

Order Reference: [PG]...\$29.95 + shipping

WORD FIND presents puzzles in which you find words embedded in letter mazes. (V4 #6)

SLOT FIND automatically examines slots and identifies your Apple configuration. (V4 #6)

SIMPLE SEARCH is a fast machine language search for Applesoft string array matches. (NE 3)

TEXT FORMATTER prevents word wraparound of your printed text. Provisions for breaking between words in 30, 40, 70, and 130 column formats. (V4 #6)

BOUNCING NUMBERS is a fun Hi-Res number recognition program for preschoolers. (V4 #6)

Order Reference: [WD]...\$23.95 + shipping

TUNES is a comprehensive music system that lets you create songs and sound effects. Sharps, flats, duration, staccato, pauses, and all of the other piano/organ effects are there at your fingertips. (NE 4)

APPLESOFT PROGRAMMING HELPER eliminates 50-80% of your program errors before you RUN your program by checking your syntax in advance. (NE 4)

DIGGER lives beneath the sands of Mars. Help him outwit his adversaries in this Hi-Res arcade game. (NE 4)

Order Reference: [TN]...\$29.95 + shipping

FILL-REVERSE adds spectacular effects to your Hi-Res graphics displays. (V4 #7)

FUNCTION GRAPHER displays two arithmetic functions on the Hi-Res screen. (V4 #7)

MULTICOPY makes up to seven copies of a disk with a single read. (V4 #7)

ENCODE-DECODE encrypts or decrypts Applesoft and binary files for program security using a 5-character key. (V4 #7)

Order Reference: [FR]...\$23.95 + shipping

RAM DISK makes your RAM card a pseudo disk for access to DOS 3.3 data and programs. Later you can save pseudo disk files to diskette for permanent storage. (NE 4)

PERSONAL APPOINTMENT CALENDAR keeps track of a year's worth of appointments with fast editing and printing. (NE 4)

APPLE TALKER lets your Apple speak using your library of words or sounds. (NE 4)

Order Reference: [RD]...\$29.95 + shipping

MUNCHIES lets you outguess the number of dots your computer will munch. (V4 #8)

AMPERPACKER saves space by packing text files before saving them to disk. (V4 #8)

APPLE TRIG plots your favorite trig functions in Hi-Res graphics. (V4 #8)

GRAPHICS 3-D explores three-dimensional graphics and hidden line removal. (V4 #8)

Order Reference: [MU]...\$23.95 + shipping

NIBBLE DINER is a personal diet planner that not only provides you with nutritional analysis of foods

and entire recipes but also helps keep track of your eating habits. The disk includes a database of over four hundred foods. (NE 5)

DOS EXTENDER makes your favorite machine language routine a permanent part of DOS 3.3. (V5 #1)

ARTILLERY DUEL is a Hi-Res shootout over the mountain tops. (V5, #1)

Order Reference: [DI]...\$29.95 + shipping

MX-80 PLOTTER makes your Epson printer into a high resolution plotter. (V5, #1)

SIR is a semi-ultimate input anything routine for entering commas, colons and other characters rejected by Applesoft. (V5, #1)

FAST FILE SEARCH speeds DOS 3.3 random access file searches by up to 20 times. (V5, #1)

BLACK BOX uses reflection and absorption of atoms to find the hidden target. (V5, #1)

Order Reference: [MX]...\$23.95 + shipping

APPLESOFT EXPANDER adds a library of routines for your DOS 3.3 Applesoft programs featuring: Hi-Res graphics text, hexadecimal PEEK/POKE and computed GOSUB/GOTO with the RAM card. (NE 5)

NIBBLE GARAGE improves your car care by tracking maintenance and generating repair reminders. (NE 5)

SPEED MAZE challenges you to navigate a random maze at top speed. (NE 5)

Order Reference: [AE]...\$29.95 + shipping

FLASHCARD uses Hi-Res graphics for map drill with record keeping and quizzing. (V5 #2)

HI-RES CHARACTER DRAWING makes text displays on the Hi-Res screen easy and quick. (V5 #2)

SAFE CRACKER challenges you to find the combination and open the safe before the cops arrive. (V5 #2)

FANCY PICTURE LOADER provides special effects for loading Hi-Res graphics. (V5 #2)

CUSTOM CATALOG lets you modify DOS 3.3 for custom file type symbols, volume headers, and file names. (V5 #2)

Order Reference: [FC]...\$24.95 + shipping

THE NIBBLE BROKER tracks your stocks and graphically displays your graphics with easy data entry and a variety of reports. (NE 5)

QUICKSORT II is a machine language routine for sorting Applesoft one- and two-dimensional strings and numeric arrays on up to nine keys. (NE 5)

STORM WARNING lets you battle the forces of a Midwestern storm to rescue town people and rebuild their houses. (V5 #3)

Order Reference: [BR]...\$29.95 + shipping

ATTACK OF THE KILLER SHAPE TABLES challenges you to zap the killer shapes before they cut your lifelines. (V5 #3)

GRAPHICS TOOLBOX is a collection of graphics utilities for swapping Hi-Res pages by superimposing them or inverting them. (V5 #3)

COMPLETE CATALOG lets you examine and recover deleted DOS 3.3 file names. (V5 #3)

SCREEN EDIT 80 lets you create 80-column text screens for display from your programs (requires an Apple IIe, 64K). (NE 5)

Order Reference: [KS]...\$23.95 + shipping

THE BASIC ASSEMBLER is an editor/assembler package that is written in Applesoft BASIC. Use it to produce machine language programs quickly and easily. (NE 5)

NIBBLE TV GUIDE keeps track of your TV program events and displays schedule conflicts. (NE 5)

SPINBALL provides arcade action with multiple balls, spinners and barriers. (V5 #4)

Order Reference: [BA]...\$29.95 + shipping

MONSTER HUNT challenges you to find the monster before he eats you up. (V5 #4)

AUTOMATIC FUNCTION PLOTTER provides auto/manual scaling and graph overlays for plotting your favorite map functions. (V5 #4)

LIFTOFF lets you save an area of the Hi-Res screen as a shape table. (V5 #4)

APPLESOFT OVERLAYS manages your memory as you swap DOS 3.3 Applesoft program sections in and out of memory from disk. (V5 #4)

Order Reference: [MH]...\$23.95 + shipping

NIBBLE KEYSOFT lets Applesoft and DOS 3.3 commands be printed in upper or lower case in the full ASCII character set. (NE 5)

PAYCHECK tracks your income and paycheck deductions for screen or printed reports. (V5 #5)

CASTLE RICHE challenges you to find the fortune hidden in the adventure castle using text and Hi-Res graphics clues. (V5 #5)

Order Reference: [KY]...\$29.95 + shipping

MATH MARATHON provides drills in the four basic operations with graphics figuring right on the screen. (V5 #5)

HIDDEN LINES creates 3-D Hi-Res graphics on the Hi-Res screen. (V5 #5)

DOUBLE HI-RES I demonstrates the principles of drawing on the double Hi-Res screen. It requires Apple IIe with extended 80-column card or Apple IIc. (V5 #5)

ANT RACE is a "text graphics racing game" — requires Apple IIe with 80-column card or IIc. (V5 #5)

AUTOMATIC CAPITALIZER prints properly capitalized output to your printer. (V5 #5)

Order Reference: [MT]...\$24.95 + shipping

NIBBLE FILE CABINET is a flexible database management system for creating variable length records with key sorts and binary tree data storage. A *Nibble* best-seller! (NE 5)

DISK CUSTOMIZER for DOS 3.3 provides one step formatting, volume header customization, and user selected HELLO program type. (V5 #6)

CLAM BAKE challenges you to outrun the jellyfish and eat all the diatoms to win in arcade action. (NE 5)

Order Reference: [CB]...\$29.95 + shipping

RPN CALCULATOR includes a visible "stack," error trapping, and help commands for a sophisticated graphics calculator. (V5 #6)

LITTLE ORGAN APPLE lets you play music from the keyboard with Hi-Res graphics. (V5 #6)

DISK MAP II shows where your DOS 3.3 files are located and how your disk is structured. (V5 #6)

KEYBOARD INTERRUPT dumps your text screen to a printer on command. (V5 #6)

Order Reference: [CL]...\$23.95 + shipping

APPLESOFT GLOBAL EDITOR provides powerful search and replace editing of your programs over a selected line range. (NE 5)

NIBBLE COLOR BILLBOARD turns your Apple into an electronic billboard for the display of colorful attention-getting messages. (V5 #7)

BRIDGE BIDDER pits you against your Apple in sharpening your bridge playing skills in Hi-Res graphics. (V5 #7)

Order Reference: [AG]...\$29.95 + shipping

PEARSON PRODUCT MOMENT CORRELATIONS calculates a complete correlation matrix from your statistical data. (V5 #7)

COUNTING QUIZ helps your preschoolers learn their numbers in Lo-Res and Hi-Res graphics. (V5 #7)

APPLESOFT VARIABLE DUMP shows a complete list of your variables and their values at any time during program execution. (NE 5)

DISK CERTIFIER marks all "bad spots" on either side of your DOS 3.3 diskette. (V5 #7)

Order Reference: [PP]...\$23.95 + shipping

SOUND SYNTHESIZER is a sound creation utility that lets you "draw" your sound effects on the Hi-Res screen. Sound effects can be stored in libraries for later use by your own programs. (NE 5)

LIST MASTER formats your Applesoft programs for easy-to-read structured listings. (NE 5)

NIBBLE BEACH HEAD challenges you to lead your troops across the beach head to win in arcade graphics. (V5 #8)

Order Reference: [SS]...\$29.95 + shipping

REGRESS provides video and printed regression analysis. (V5 #8)

LITTLE FINGERS helps young typists learn the keyboard. Designed for small hands. (V5 #8)

APPLESOFT ANTI-LINE CRUNCHER expands multi-statement Applesoft programs to give each statement its own line number. (NE 5)

MON-E runs under DOS 3.3 and provides a separate monitor in extended 80-column memory. It lets you switch back and forth to check the current status of your programs—requires a IIe with extended 80-column card or IIc. (V5 #8)

Order Reference: [RG]...\$23.95 + shipping

NIBBLE GRADE BOOK lets you track and compute grades for up to ten classes of 80 students each. Record, analyze, and assign grades with ease. (NE 5)

RAM DISK 64 creates 170-sector pseudo disks on your 128K IIe or IIc for fast access with normal DOS 3.3 commands. Requires Apple IIe with extended 80-column card or Apple IIc. (NE 5)

MATHEMAGICIAN is an adventure game that combines education with fun in building math skills. (V5 #9)

Order Reference: [GB]...\$29.95 + shipping

COMPASS QUIZ offers drill, practice, and progress tracking for learning the principle directions of the compass in Hi-Res graphics. (V5 #9)

TADPOLE ALPHABET lets your preschooler learn the alphabet in an arcade style game. (V5 #9)

PROMENU lets you select system time and date and explore the ProDOS directory tree with a series of menus — 64K Applesoft and ProDOS required; must be converted before use. (V5 #9)

SOLID STATE SLIDE SHOW stores Hi-Res pictures in your RAM card (or upper 16K on the IIe) for superfast display. (V5 #9)

Order Reference: [CQ]...\$23.95 + shipping

HI-RES HOUDINI is a powerful machine language graphics utility for creating special graphics effects including shift, merge, swap, and inverting both Hi-Res screens. (NE 5)

POSTMASTER keeps records for up to 100 labels which can be sorted and custom printed with special options that you select. (V5 #10)

3-D FOUR SCORE is a three-dimensional Tic Tac Toe in Lo-Res graphics. (V5 #10)

Order Reference: [HH]...\$29.95 + shipping

DHR PALETTE is a graphics utility for designing double Hi-Res graphics screens and saving them to disk — requires a IIe with extended 80-column card or IIc. (V5 #10)

FATHER'S FIRST PROGRAM is a collection of four programs in graphics designed with children in mind. (V5 #10)

AUTOLOG keeps track of your sessions on the computer using "log on" and "log off" reporting. (V5 #10)

HEX PEEKS, POKES, AND CALLS allows you to

execute these commands from Applesoft using hexadecimal notation. (V5 #10)

Order Reference: [HP]...\$23.95 + shipping

COUPMAN will help you keep track of your grocery coupons for greater savings. Analyzes and prints reports based on expiration date, coupon category, and more. (NE 5)

APPLESOFT BUG CHASER helps you eliminate program bugs by continuously displaying the value of a selected variable during program execution. (NE 5)

GOLF PRO lets you design your own golf course and play the holes in Hi-Res graphics. (V5 #11)

Order Reference: [CP]...\$29.95 + shipping

CROSSWIND is a dramatic simulation of a football kick with control over velocity, angle, and wind direction in Hi-Res graphics. (V5 #11)

COMPOSITE BIORHYTHMS shows your biocycles individually and combined in Hi-Res graphics. (V5 #11)

MACHINE CODE EDITOR disassembles machine code as you enter it for instant feedback and comparison to the original. (V5 #11)

Order Reference: [CW]...\$23.95 + shipping

STOCK ANALYST automatically evaluates your portfolio, including the status and history of individual stocks and your entire holdings. (NE 5)

AMPERGO is a powerful ampersand utility that lets you write Applesoft programs using labels for GOTO and GOSUB statements. (NE 5)

OBELISK challenges you to pilot your rover vehicle to the mother ship, avoiding death rays from alien ships and obelisks. (V5 #12)

Order Reference: [AN]...\$29.95 + shipping

MATH CONCENTRATION reveals "concentration panels" as a reward for solving math problems in Hi-Res graphics. (NE 5)

MORTGAGE CALCULATOR displays your monthly payment and total payments when a loan amount, interest rate, and term are entered. (V5 #12)

DOUBLE HI-RES GRAPHICS ROUTINES include the driver routines and sample programs presented in the Graphics Workshop — 128K required on the IIe or IIc. (V5 #12)

RAM RESERVATION CENTER is a ProDOS utility for reserving or freeing areas of RAM so that ProDOS will respect the new boundaries — requires ProDOS and at least 64K. (V5 #12)

Order Reference: [MM]...\$23.95 + shipping

NIBBLE ARCHITECT is a powerful program for planning your room design. Scaled, Hi-Res graphics objects can be easily moved, changed, copied, printed, and saved to disk for professional quality results. (V6 #1)

POWERKEY lets you define single keyboard macros for simple entry of DOS 3.3 commands and program statements. Dramatically reduces program typing. (V6 #1)

CLAUSTROPHOBIA pits you against aliens from the sky who try to trap your gunner. Bring them down in neat columns at the edge of the screen to win. (V6 #1)

Order Reference: [NA]...\$29.95 + shipping

SYSTEM SOLVER will solve any set of up to 70 linear equations with up to 70 unknowns. (V6 #1)

CALORIE COUNTER helps track your calorie consumption while it builds a database on disk as you add new foods to your diet. (V6 #1)

CATALOG PLUS lets you find and catalog DOS 3.3 disks by file type and initial character. (V6 #1)

APPLESOFT EXECUTION MONITOR graphs a chart of your program's execution showing the program statements that are executed most often. A powerful tool for optimizing Applesoft programs. (V6 #1)

Order Reference: [SY]...\$23.95 + shipping

SPOOLER keeps your printer busy while you keep computing. Uses the 16K RAM card area to store printer output as you work under DOS 3.3. (V6 #2)



NIBBLE PAGE EDITOR lets you create up to 8 pages of information with cursor oriented screen editing, printing, or disk storage. (V6 #2)

THE NIBBLE 500 challenges you to race for glory through a curving track with random obstacles and a pit stop. (V6 #2)

Order Reference: [SP]...\$29.95 + shipping

PERPETUAL CALENDAR will print a full page calendar for any year since 1753. (V6 #2)

DOUBLE HI-RES ROUTINES include the final routines for vertical shifting in the double Hi-Res driver, including a demonstration program and the entire DHR driver — requires 128K IIe or IIc. (V6 #2)

DOS TRICKS lets you obtain disk boot statistics, read/write statistics, and create a "scratch pad" text file on DOS 3.3 disk for quick reference information. (V6 #2)

DISK LOCK helps you avoid writing over valuable data by fooling DOS 3.3 into thinking that your disk is full. (V6 #2)

Order Reference: [PC]...\$23.95 + shipping

NIBBLE MEDIC will help you keep track of your family's medical expenses and prescription history with a variety of editing and report formats. (V6 #3)

TINY COMPILER is an Applesoft post-processor that speeds your program's execution up to 20%. (V6 #3)

TRIVIA MASTER challenges you to beat the clock at answering trivia questions. The disk includes a file of 200 questions to get going. (V6 #3)

Order Reference: [MD]...\$29.95 + shipping

LUCK converts all your upper and lower case program text to upper case for easy formatting of listings. (V6 #3)

TEXT VIEWER scrolls quickly through your text files without having to boot your word processor. (V6 #3)

PRODOS CRYPTOGRAPHY disassembles ProDOS's message printer and includes a utility printer to build and display your own messages. (V6 #3)

AMPERDHR is a library of graphics routines to simulate normal Hi-Res commands in double Hi-Res graphics — requires 128K. (V6 #3)

SCREEN SPINNER builds eye-catching screen borders by spinning your message around the perimeter of the display. (V6 #3)

Order Reference: [LK]...\$24.95 + shipping

APPLE HIGHWAYS will find the best route between 170 major U.S. cities and print both the route and the mileage between junctions. (V6 #4)

NIBBLE GAS MISER tracks your gas mileage and graphs the results in Hi-Res graphics. (V6 #4)

IDOL OF MONTEREY is a text adventure game in which you battle the monsters of the forest to regain the precious idol. (V6 #4)

Order Reference: [HI]...\$29.95 + shipping

APPLE TIME TUTOR uses the Hi-Res screen with several clock formats and levels of difficulty for youngsters of different ages. (V6 #4)

BLOCK SHAPE ANIMATION IX includes a series of routines for single-byte block shape animation. (V6 #4)

BEEP CUSTOMIZER lets you modify Apple's tone and include the changes in your own programs. (V6 #4)

PRODOS DATE AND TIME allows you to set the date and time without a clock card within ProDOS. (V6 #4)

INPUT AND EDIT uses the ampersand to allow editing within an input field. (V6 #4)

Order Reference: [TM]...\$24.95 + shipping

APPLESOFT SUPERCHARGER is a set of machine language utilities that use ampersand commands to format output, control user input, chain programs with common variables, and much more. (V6 #5)

BANNER BOSS creates custom banners in two letter sizes with underlining and emphasized print features. (V6 #5)

ADVENTURE CONSTRUCTION SET lets you design and play your own adventure games. (V6 #5)

Order Reference: [BB]...\$29.95 + shipping

UNIVERSAL METRIC CONVERTER converts English and metric units with menu-driven ease. (V6 #5)

AUXILIARY MEMORY EXAMINER is an ampersand-driven utility that lets you examine any portion of the 128K of RAM in an Apple IIc or extended IIe. (V6 #5)

BASIC ASSEMBLER ENHANCEMENTS improves Nibble's BASIC Assembler with powerful printing and editing features. (V6 #5)

PAGE lets you draw Hi-Res pictures and save them on disk as screens or as program lines that you can merge with your favorite Applesoft routine. (V6 #5)

Order Reference: [UM]...\$23.95 + shipping

CHART MANAGER creates sophisticated Hi-Res scatter plots, bar graphs and pie charts from data you key in or read from disk. (V6 #6)

DOS DESIGNER is a menu-driven system that allows you to change DOS 3.3 commands, create custom error messages, alter the disk volume heading, and more. (V6 #6)

ANTS! is a Hi-Res action game that pits you against hordes of giant, invading ants bent on destruction! (V6 #6)

Order Reference: [CM]...\$29.95 + shipping

BLOCK SHAPE ANIMATION X is an ampersand command interpreter for block shape animation that lets you access commonly used routines without using their CALL addresses. (V6 #6)

CHICKEN LITTLE'S TYPING GAME teaches you the basics of touch typing. To score you must type the letters that fall from the top of the screen. (V6 #6)

VIGILANT FID lets you store the FID program in the RAM card area of memory and access it with a simple command for speed file manipulation under DOS 3.3 (V6 #6)

PRODOS TYPE COMMAND adds a convenient TYPE command to ProDOS so you can dump an ASCII version of any file to any output device in immediate and deferred modes. (V6 #6)

PROGRAMMING THE APPLEMOUSE II demonstrates mouse programming techniques with Applesoft and machine language. Create line drawings on the Lo-Res screen and determine the mouse's coordinates with these two sample programs. (V6 #6)

Order Reference: [BS]...\$23.95 + shipping

NAVIGATOR makes program documentation a breeze! It formats Applesoft listings and prints flowcharts complete with graphics symbols. (V6 #7)

NIBBLE MAESTRO transforms the Apple keyboard into a four-octave organ. Notes appear on a staff as you play, and you can save tunes to disk and edit or play them later. (V6 #7)

LIGHTNING COPY copies disks quickly with a two-drive system under DOS 3.3 You control the error handling for fast, foolproof copying, even with damaged disks. (V6 #7)

Order Reference: [NV]...\$29.95 + shipping

IRA COMPARISON CHART calculates the future value of an Individual Retirement Account (IRA) and compares it to your return on another investment. It even allows you to adjust for inflation. (V6 #7)

ASSEMBLY II includes two machine language programs. One produces music from the Apple keyboard; the other converts between the binary, decimal and hexadecimal number systems. (V6 #7)

EYE OPENERS creates an opening iris effect for dramatic transitions from one Hi-Res display to the next. (V6 #7)

SUPER REM REMOVER removes REMs from Applesoft programs for faster program execution and more compact code. Run the speedy, REM-less version of your program, and save a fully documented program listing for reference. (V6 #7)

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ONE-LINER AND TWO-LINER WINNERS

This one-liner by Andrea Sigurdson of Sydney, BC, Canada is a cute way to display a message. Just follow the arrow as it points to each letter. To program your own message, replace the DATA elements at the end of the line with your own values. A is represented by 1, Z by 26, and the separation between words by 33. Then change the FOR A statement to the total number of DATA elements.

```
5 HOME : PRINT "WATCH THE
  ARROW SPELL A MESSAGE
  E": VTAB 8: PRINT "AB
  CDEFGHIJKLMNOPQRSTUVWXYZ
  NEW WORD": FOR A =
  1 TO 31: VTAB 9: READ
  H: HTAB H: PRINT "A":
  : FOR C = 1 TO 2000: NEXT
  C: HTAB H: PRINT " ":
  NEXT A: DATA 20,1,1
  1,5,33,1,33,14,9,2,2,
  12,5,33,15,6,33,1,14,
  33,1,16,16,12,5,33,20
  ,15,4,1,25
```

With this DOS 3.3 utility by Eric Snyder of Bloomington, MN, you can display the disk catalog and then choose from a menu of ten DOS commands. The program then asks for the file name and executes the command. For the commands PR# and IN#, enter the slot number when the file name is requested.

```
2 PRINT CHR$(4): "CATALOG
  G": RESTORE : FOR A =
  1 TO 10: READ C$(A): NEXT
  A: FOR A = 1 TO 10: PRINT
  A: "=": C$(A): NEXT A: PRINT
  "11=CATALOG": INPUT "
  CHOICE? ": A: ON (A <
  1 OR A > 10) GOTO 2: INPUT
  "FILE? ": B$: PRINT CHR$(4): C$(A): " ": B$: DATA
  LOAD, BLOAD, RUN, BRUN, U
  NLOCK, LOCK, DELETE, VER
  IFY, PR#, IN#
```

Here's a DOS 3.3 utility that modifies the CATALOG command. When you execute the CATALOG command, the program asks for the file type (A, B, I, R, S, T or =), and then lists only that type of file. Thanks to Michiel Berger of Den Burg Texel, Holland.

```
1 D$ = CHR$(4): PRINT D$
  "OPENCAT": PRINT D$ "W
```

```
RITECAT": PRINT "CALL
-151": PRINT "ADAF:8
BD B0 N ADB9:20 C FD
85 0 20 ED FD 20 2F A
E 20 2F AE EA EA N AD
DD:4C E8 AD N ADF6:20
B8 B6 N B6B8:B9 A7 B
3 C5 0 D0 1 60 A5 0 C
9 BD F0 6 B9 A7 B3 4C
25 AE B9 A7 B3 60"
2 PRINT "B3B0:BA C5 D0 D9
D4 C5 CC C9 C6": PRINT
"3D0G": PRINT D$ "CLOS
ECAT": PRINT D$ "EXEC
AT"
```

Gene Masse of Belchertown, MA sent us an eye-catcher — his two-liner simulates the motion of a bouncing ball. When you run it, a ball bounces up and down on the Hi-Res screen until it comes to rest.

```
1 FOR G = 24576 TO 24582:
  READ R: POKE G,R: NEXT
  : POKE 232,0: POKE 23
  3,96:X = 140:Y = 0:M =
  0:HGR2 = SCALE = 2: ROT=
  6: FOR G = 1 TO 180: HCOLOR=
  3: DRAW 1 AT X,Y: IF
  Y > 180 THEN M = - M
2 DRAW 1 AT X,Y:M = M + 2
  : HCOLOR= 0: DRAW 1 AT
  X,Y:Y = Y + M: FOR P =
  1 TO 20: NEXT P,G: HCOLOR=
  3: DRAW 1 AT X,Y: DATA
  1,,4,,53,39,
```

Many variations on John Conway's game of Life have been created. In this two-liner version by William K. Richards of Martinez, CA, each dot represents a living cell. If a living cell is surrounded by two or three living cells, it survives to the next generation. A dead cell comes to life when it is surrounded by three living cells. This Hi-Res version is seeded by an r-shaped pentomino pattern. Just BRUN LIFE or BLOAD LIFE and CALL 4096.

To seed it with your own starting pattern, start by performing HGR and HGR2. Then POKE the location of each living cell into memory using the formula:

POKE X * 256 + 8192 + 128 + Y, 255

where X and Y are the screen coordinates in the range 1-38. CALL 4119 to start the manually seeded version. To key in the program, enter the Monitor with CALL -151,

type in the hex code, and save it with the command:

BSAVE LIFE,A\$1000,L\$B0

```
1000- 20 D8 F3 20 E2 F3 A9 FF
1008- 8D 95 34 8D 95 35 8D 96
1010- 34 8D 96 33 8D 97 34 AD
1018- 50 C0 AD 54 C0 AD 56 C0
1020- 20 36 F8 A9 00 85 06 A9
1028- 80 85 08 A2 27 86 EB A0
1030- 27 84 EC A5 EB 18 69 20
1038- 85 07 85 09 A4 EC B1 08
1040- 85 30 29 01 91 06 A4 EB
1048- A5 EC 20 00 F8 C6 EC D0
1050- EB C6 EB D0 DA A2 27 86
1058- EB A0 27 84 EC A5 EB 18
1060- 69 20 85 07 85 09 A4 EC
1068- A9 00 18 71 06 C8 71 06
1070- C6 07 71 06 88 71 06 88
1078- 71 06 E6 07 71 06 E6 07
1080- 71 06 C8 71 06 C8 71 06
1088- 88 C6 07 C9 03 F0 0E C9
1090- 04 F0 06 A9 00 91 08 F0
1098- 08 B1 06 F0 F6 A9 FF 91
10A0- 08 C6 EC D0 C1 A0 27 84
10AB- EC C6 EB D0 B0 4C 2B 10
```

TYPING TIPS

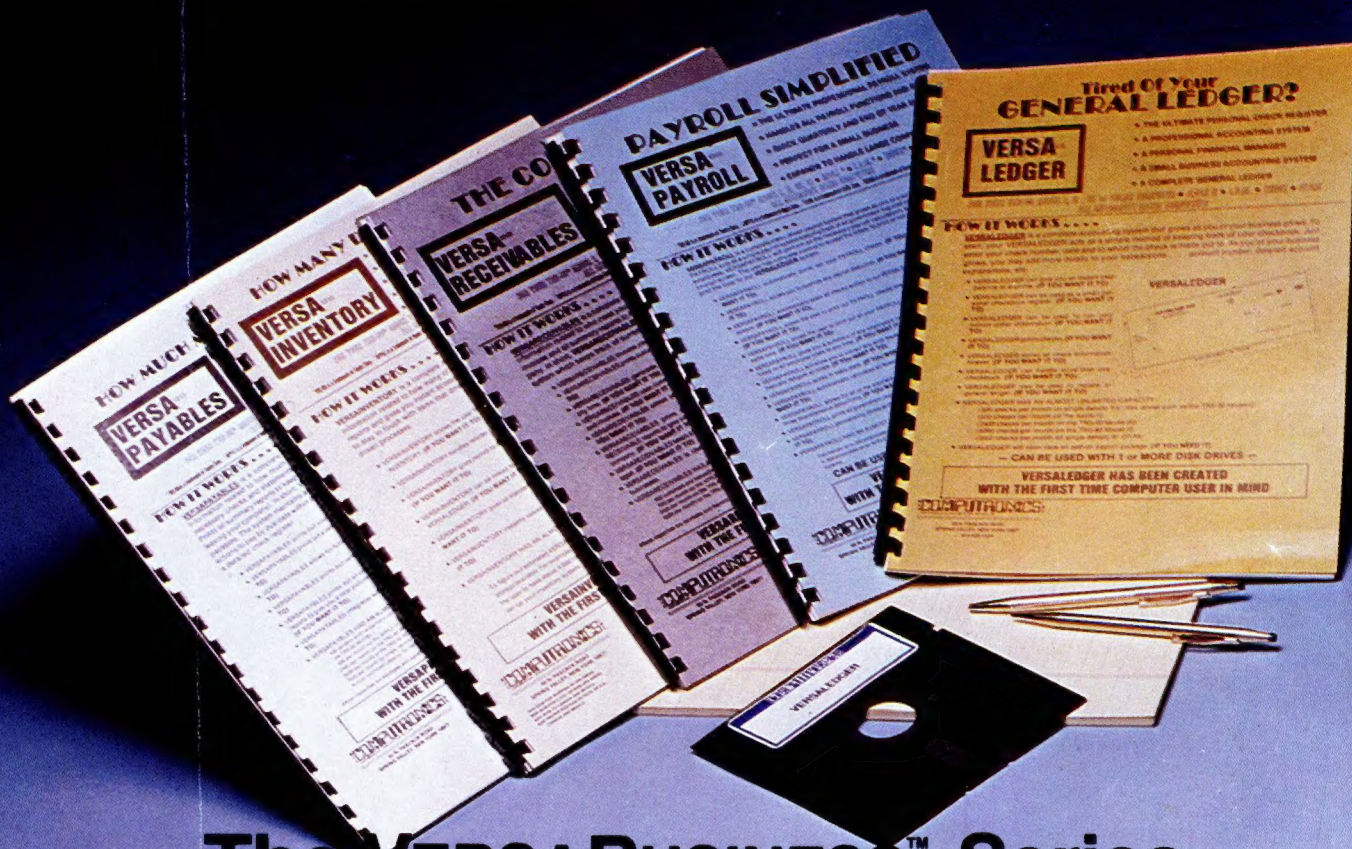
Here are a few tips for typing in one-liners and two-liners. Be sure to omit spaces when typing in Applesoft programs, unless the spaces appear in strings between quotes, or in REM or DATA statements. You'll find it easier (and often essential) to substitute the question mark (?) for the PRINT statement. And when typing in machine language programs, it's safe to type in just the second digit of a hexadecimal pair if the first digit is a zero, e.g., the hex pair 03 can be typed in simply as 3. For more information on typing in programs, see "A Welcome to New Nibble Readers" at the beginning of this issue.

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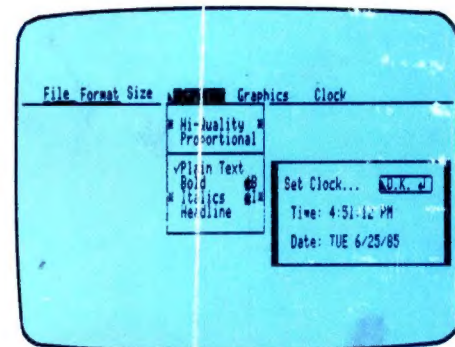
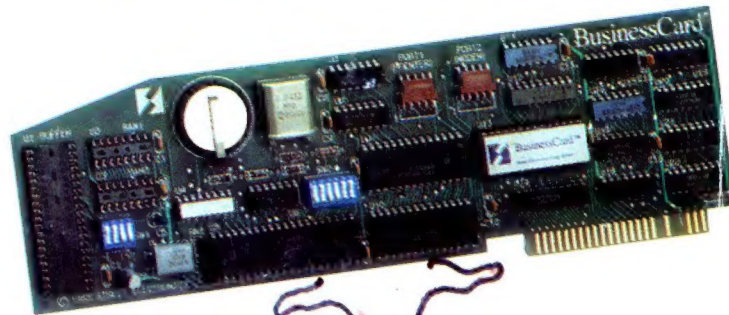
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